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A Summary of Current Program, 10-1-62;
and Preliminary Report of Progress
for 10-1-62 to 9-30-63

RESOURCE DEVELOPMENT ECONOMICS DIVISION
of the
ECONOMIC RESEARCH SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

This progress report of U.S.D.A. and cooperative research is primarily a tool for use of scientists and administrators in program coordination, development and evaluation; and for use of advisory committees in program review and development of recommendations for future research programs.

The summaries of progress on U.S.D.A. and cooperative research include some tentative results that have not been tested sufficiently to justify general release. Such findings, when adequately confirmed will be released promptly through established channels. Because of this, the report is not intended for publication and should not be referred to in literature citations. Copies are distributed only to members of Department staff, advisory committee members and others having a special interest in the development of public agricultural research programs.

This report also includes a list of publications reporting results of U.S.D.A. and cooperative research issued between October 1, 1962, and September 30, 1963. Current research findings are also published in the ERS publications The Farm Index, a monthly, and Agricultural Economics Research, a quarterly. This progress report was compiled in the Resource Development Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C., 20250.

UNITED STATES DEPARTMENT OF AGRICULTURE
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TABLE OF CONTENTS

	<u>Page</u>
Introduction.....	ii
Area No. 1. Economics of Land Utilization.....	1
Area No. 2. Economics of Water Utilization.....	5
Area No. 3. Legal-Economic Aspects of Land and Water Use.....	14
Area No. 4. Land Tenure.....	22
Area No. 5. Impacts of Urban Growth on Rural Areas.....	31
Area No. 6. Economic Development Problems and Programs in Rural Areas.....	36
Area No. 7. Incomes, Employment and Resources of People in Selected Rural Areas.....	43
Area No. 8. Rural Area Economic Structure and Economic Growth.....	49
Area No. 9. Economic Framework and Criteria for River Basin and Watershed Development.....	52
Area No. 10. River Basin Development Investigations.....	56
Area No. 11. Watershed Program Analysis.....	61
Line Project Check List.....	68

INTRODUCTION

Resource development economics research deals with many and varied economic problems of land and water-resource management and rural area development. The work is concerned with the extent, use, development and control of land and water resources and rural area economic development, including the economics of land and water utilization, tenure, resource institutions, and impacts of urban expansion; area economic development problems, programs, structure, and renewal and growth potentials; river basin and watershed project and program planning and evaluation; and development and implementation of resource policy.

Continuing pressure on shifts in land and water resource use is being exerted by both improved technology in agricultural production and expanding nonagricultural requirements. Trends toward increased size of farms and reduced farming opportunities, along with increasing concern over the development, use, and conservation of the Nation's land and water resources, and growing apprehension over the problems of rural people and rural economic opportunities require a thorough and comprehensive program of research in the field of resource development economics. Results of resource economics research are used widely as aids in management decisions at the farm, community, area, State, regional, river basin, and national levels.

The Department's program of research and related service in resource economics is conducted from headquarters in Washington, D.C., and is concerned chiefly with types of problems that are regional or national in scope. Field studies generally are conducted in cooperation with State experiment stations or Federal and State resource development agencies. Close working relationships with both research and operational programs have long been traditional in this field. Close cooperation in planning and conducting work avoids duplication of efforts and provides opportunities for the direct application of research results.

The resource economics research program is covered under 11 area headings shown in the Table of Contents. More detailed subheadings are given in the discussion of each area of work.

In the 12 months since progress was last reported to research advisory committees, the Division has made a number of significant contributions to resource policies and programs. Division personnel have responded to many requests for assistance from the Office of the Secretary, program administrators, the President's Water Resources Council, the Federal Council for Science and Technology, and others. In addition, basic data and analyses provided by the Division have become increasingly important in efforts to understand changes and achieve improvements in the development and use of resources, the structure of the rural economy and the well-being of agriculture. Some examples of research accomplishments contributing to resource policy and programs follow:

Cropland changes. Levels and trends in cropland acreage are highly significant for most production adjustment programs. The acreage of cropland used for crops in the United States increased from 368 million acres in 1940 to a peak of 387 million acres in 1949. By 1962, land used for crops had dropped to a low of 330 million acres, the smallest since 1910. Significant changes occurred among regions in the amount of land used for crops during this period. Since 1949, the use of land for crops has declined by the greatest percentage in the Appalachian and Southeast regions. Although the Corn Belt and Northern Plains had relatively stable cropland acreages for many years, sharp decreases occurred in 1961 and 1962, reflecting the impact of new Government programs. The Mountain and Pacific regions have shown a strong tendency to maintain and expand their cropland acreages irrespective of national trends.

Trends in agricultural water use. Water is becoming an increasingly scarce resource in many parts of the country. The principal agricultural water requirement is for irrigation. An estimated 36 million acres of land were irrigated in the United States in 1963, or about double the area irrigated in 1940. Irrigated acreage has been expanding at an average annual rate of over 3 percent during the last two decades. Irrigated land currently comprises 8.5 percent of all cropland harvested and accounts for about 20 percent of the value of crops produced.

Around 38 percent of all water withdrawn from stream and ground water sources is used for agricultural purposes. However, agriculture accounts for about 85 percent of all consumptive water use. Although agricultural withdrawals are expected to drop to about 20 percent of the total by 1980, consumptive use by agriculture would still account for about 75 percent of all consumptive uses. This relatively high consumptive use emphasizes the importance of more efficient use of water in agriculture, particularly in the water-short areas of the Nation.

Irrigation water values. The value of water in various uses is significant in dealing with the problem of water allocation. Sale prices of irrigated land in northeastern Colorado for 1954-60 were analyzed to derive estimates of the capitalized values of irrigation water. An average annual supply of one acre-foot of water was valued at \$29 from farm wells and \$21 from surface sources. Separate sales of irrigation company stock in the area indicate a present value of \$29 per acre-foot of annual supply. Supplemental surface water brought into the area through the Colorado-Big Thompson transmountain diversion project is apparently valued at about \$26 per acre-foot of annual supply.

Idle land in the rural-urban fringe. Numerous tracts of idle, undeveloped land are being left on the rural-urban fringe of cities as rapid suburbanization occurs. A study in northern Delaware indicates that these unused tracts of land, many acquired for speculative purposes, add to the problems of urban sprawl and help increase the high public costs of extending

highways, utilities, and services. In 1960, physical or locational limitations with respect to public services detracted seriously from the development potential of two-thirds of the bypassed, privately owned idle tracts of 10 acres or more in the study area. An additional one-fourth of the tracts had fair development potential, and only one in 10 was rated as excellent. Public access by highway to most of the tracts is excellent. A potential use for a substantial number of these idle tracts would be as parks, outdoor recreation sites, wildlife management areas, and other "open space" uses.

Recreation, tourism and vacation farms. There is widespread interest in the provision of adequate facilities to meet the increasing demand for outdoor recreation. Exploratory studies indicate that there are favorable opportunities for carefully planned recreational enterprises on farms and in rural areas. A study of employment and income provided by recreation activities in the Missouri Ozarks shows that more than one-fifth of the volume of business in the area stems from recreation, and that this source of business has doubled during the last 10 years. Recreational activities provide employment and moderate incomes for approximately 5,000 persons in the area.

A study of recreational enterprises on farm and nonfarm property in a few selected areas indicates that many operators obtain income from this source. More than one-half of the enterprises surveyed were carried on as a part of the farm operation. A study of vacation farms in East Central Ohio indicates that vacation facilities on farms can increase farm incomes, strengthen family farms, and provide city people with an enjoyable experience. Annual net incomes from these seasonal vacation farm enterprises in recent years ranged up to \$1,500. The overall result has been a better use of farm resources and a boost to the local economy.

Rapid growth in special resource districts. About 7,000 fiscally and administratively independent special districts in the United States deal with the utilization of natural resources. These districts often have powers of taxation, bonding, and property acquisition. They account for about 40 percent of all special units of government. The size ranges from special-purpose districts encompassing a small area and serving a few landowners to the multifunction type, serving thousands of people, encompassing hundreds of thousands of acres, extending across State boundaries, and having indebtedness running into the millions of dollars. This type of local organization, of which the Soil Conservation Districts are but one example, provide the principal means used by groups of rural landowners and operators and rural-urban residents in transforming and developing their land and water resources. New variations of special resource districts with unique objectives continue to be organized and the total number of districts has nearly doubled in the past 15 years. Although some work effectively in developing and managing natural resources, others are in need of guidance and improvement.

Farm tenure opportunities. Opportunities to lease land depend increasingly upon family ties. In 1960, about one-third of the rental arrangements in the United States were made with parents, grandparents, or children of the farm operator or his wife, compared with one-fourth in 1950 and one-fifth in 1930. Analyses show that leasing arrangements are used to start new farmers, to expand operations, and to afford retirement.

Underemployment in rural areas. Unemployment on farms and in rural areas is not readily apparent and can be measured only through some concept of "underemployment." The unemployment equivalent of underemployment on farms and in rural areas is estimated at approximately 2.2 million persons. This unemployed equivalent is 13 percent of the total rural labor force. More than one-half of this is accounted for by rural farm males in the age group 20 to 64 years.

Rural area occupations. Rural people are increasingly engaging in nonfarm occupations. Even on farms, nearly 32 percent of employed males are working at nonfarm jobs. Off-farm sources of income by farm operator families are becoming more significant for all income groups. This reflects declining job opportunities in agriculture and a shift to higher income potentials of nonagricultural employment. The wide distribution of employment of farm and nonfarm rural persons indicates that these people can and do adjust rather rapidly to other opportunities. The rural labor force has gained job qualifications and experiences that furnish a foundation for further economic development in many areas.

Urban expansion in rural areas. Farmers and other residents of rural areas and State and local officials throughout the country are increasingly concerned with the impacts of urban and industrial development in rural areas. A recent study of land-use changes in the mountainous areas of northwestern Virginia and adjacent areas of West Virginia reflect an increasing conversion of agricultural acreage to weekend and vacation residential uses. Residential-recreational subdivisions are multiplying as city people turn to the mountains for recreation and relief from summer heat, and the satisfaction of owning "a place in the country." Effects include the problems of congestion, the quantity and quality of the water supply, and the need for more effective sanitary measures. Builders and buyers alike often are caught unaware by these and similar problems. Most development plans originally were for weekend and vacation housing and recreational uses. Significant numbers of buyers, however, decided to utilize these facilities for retirement homes. The changed objectives have brought new service problems, but at the same time have offered new opportunities for developing ways to provide better service for both vacation and permanent residents.

AREA NO. 1. ECONOMICS OF LAND UTILIZATION

Problem. The land-resource situation is being affected significantly by population growth, changing consumer demands, and advances in agricultural production technology. There is a continuing need for analyses of levels and trends in the major uses of land, the economics of land development and conservation measures, and of shifts in land use advantageous from the standpoint of society as a whole. Such analyses are needed for informed policies and programs of land-use adjustment and the conservation and development of land resources.

PROGRAM

The program of research in the economics of land use and development may be subdivided into two subareas: (A) Inventory and appraisal of land supplies and uses; and (B) land requirements, conservation and development. This research provides a systematic and continuing inventory of major land uses, both farm and nonfarm, regional and national; analyzes trends in the nature and intensity of land use by States and regions, including shifts in major agricultural uses and acreages absorbed by nonagricultural uses; appraises historical programs of cropland retirement and conversion as a basis for decisions relating to current problems of land use; evaluates the need, potential, costs and returns of different land development and conservation measures in selected areas of the country; and analyzes projected national agricultural output requirements and nonagricultural needs in terms of the demand for land, the adequacy of the land-resource base, and implications for patterns of production.

Research in this area is principally applied although particular segments of the overall program may be considered as basic research. The nature of the research makes it necessary to draw upon several scientific disciplines; including economics, statistics, geography, soils, agronomy, and forestry. During the reporting year, research was formally cooperative with the State Experiment Stations of Iowa, Michigan, Nebraska, and Virginia. In addition, there is informal cooperation with many State and Federal governmental agencies, several State experiment stations, and other organizations.

Approximately 5.3 professional man-years were devoted to this research program during the reporting year, including non-Federal professional personnel working under cooperative agreements with State experiment stations. Broken down by subareas of investigation, professional personnel commitments were as follows: inventory and appraisal of land supplies and uses, 2.7 man-years; land requirements, conservation and development, 2.1 man-years; and program leadership, 0.5 man-year.

PROGRESS

A. Inventory and Appraisal of Land Supplies and Uses

An inventory of the extent and use of State-owned lands is being made to update a similar survey made in 1950. One hundred and eight agencies, or less than one-third of those administering State-owned lands, have been surveyed to date. However, agencies already surveyed include most of those administering large acreages; in total, they account for 58 million acres, or more than 70 percent of the 80 million acres found in State ownership in 1950. A very preliminary analysis of these data suggests that the total acreage of land owned by States has not changed greatly since 1950 but that the acreage devoted to recreational and wildlife areas has increased significantly in some States.

Concerning trends in the acreage of cropland used for crops, analysis indicates that 330 million acres were so used in 1962 as compared with 339 million acres in 1961. This represents a decrease of about 3 percent and was the smallest acreage used for crops since 1910. Decreases of over 2.5 million acres in the Northern Plains, about 1.5 million acres in both the Southern Plains and Lake States, and approximately 1 million acres each in the Corn Belt and Southeast regions, accounted for about 82 percent of the total decrease. In the Northeast, Appalachian, Delta, and Pacific regions, decreases ranged from 0.1 to 0.8 million acres. An increase in the acreage of cropland used for crops occurred only in the Mountain region, which was up 0.2 million acres, or about 0.5 percent. Preliminary estimates indicate a slight increase in cropland used for crops in 1963.

An economic appraisal of the Federal Agricultural Land Purchase and Development Program of the 1930's is being made to develop information useful in making decisions relative to cropland retirement and conversion to other uses. Projects and land acquired under this program frequently are referred to as land utilization (LU) projects and lands. This study has been under way for about 6 months and the effort to date has involved the location and review of reports, files, and statistics from several agency sources, and the piecing together of scattered information on accomplishments of the program.

The land utilization program has had a complex history of acquisition and subsequent development and management. Six Federal agencies have held the major responsibility for planning, acquisition, development, and management. Four of these agencies served in the first 5 years of the program. Former "LU" lands now are held primarily by seven different Federal agencies and by two or more State agencies in each of 30 States. Consequently, documentary materials pertaining to the program are very diverse and widely scattered.

Records indicate that approximately 12 million acres of farm and rangeland were acquired and developed under this program for forestry, grazing, wildlife, and recreational uses. Of this total, about 10 million acres were

acquired and developed as agricultural projects of which about 9 million acres are primarily in Federal range and forest and related multiple uses, such as protection of watersheds, production and preservation of wildlife, and recreational areas. One million acres of the 10 are chiefly in State and local forests, parks, wildlife refuges, and other uses, including experimental areas, demonstration areas, and institutional sites. An additional 2 million acres were acquired during the same period as Indian, park, and wildlife projects.

The improvement of land-use statistics is being studied by a committee consisting of members from both agricultural and urban oriented Federal agencies and other organizations. This committee has held a series of similar meetings to discuss such topics as the role of land-use statistics, their current status, need for improvement, problems of concepts and definitions, and elements of an improved system of land-use statistics. It is anticipated that the work of this committee will culminate in a published report of which four chapters and appendices are currently in draft form.

A study of the economics of classifying farmland between alternative uses has been completed and the results published by the Nebraska Agricultural Experiment Station. This research was directed toward development of a method for identifying the crop-range economic margin in the Great Plains area. In an application of the method in Kimball County, Nebraska, it was determined that farmers tended to use land for range rather than wheat on soils typically yielding less than 5.8 bushels of wheat per planted acre. Estimates were made of the wheat prices which would cause various soils to become marginal as between grass and wheat under different production cost assumptions. Assuming 1959 levels for wheat and beef production costs and average 1955-59 beef prices, the group of soils with highest yields (16.8 - 20.8 bushels per planted acre) would become marginal at a farm price of \$0.78 per bushel for wheat.

B. Land Requirements, Conservation, and Development

Participation in the preparation of a final report on the National Inventory of Soil and Water Conservation Needs continued during the past year. Two reports, a graphic summary of the major findings and basic statistical data for each of the 50 States, have been published. The final report is in draft form. It will present a summary and analysis of the findings of the Conservation Needs Inventory for the United States and tabular data for the 10 farm production regions.

Cooperative work is continuing on economic models for appraising future land and water resource requirements and alternative patterns of use. The theoretical implications of models which merge input-output analysis with linear programming have been reported in a mimeographed release by Iowa State University. Highly aggregated empirical tests of these models are being attempted with available data for the purpose of detecting weaknesses in the models.

PUBLICATIONS

A. Inventory and Appraisal of Land Supplies and Uses

Contribution to: Changes in farm production and efficiency--a summary report. 1962. Statis. Bull. No. 233. U.S. Dept. of Agr.

Contribution to: Changes in farm production and efficiency--a summary report. 1963. Statis. Bull. No. 233. U.S. Dept. of Agr.

Supplement II to changes in farm production and efficiency--a summary report. 1962. Statis. Bull. No. 233. U.S. Dept. of Agr.

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Gensurowsky, Walter and Timmons, John F. 1962. Integration of input-output and programming in land resource supply analysis. Mimeograph. Iowa State University.

Regan, Mark M. and Wooten, Hugh H. 1963. Land use trends in relation to the urbanization of the economy. Yearbook of Agriculture.

Steele, Harry A. and Landgren, Norman E. 1963. Demands for land - past, present and future. Farm Policy Forum, Vol. 15, No. 3. pp. 29-36.

Steele, Harry A. and Landgren, Norman E. 1963. Land for agriculture. In Land Use Policy and Problems in the United States. Univ. of Nebraska Press. pp. 203-230.

Steele, Harry A. and Otte, Robert C. 1962. Resource conservation research needs. In Conservation - A Key to World Progress, Proceedings of Seventeenth Annual Meeting, Soil Conservation Society of America.

Steele, Harry A. and Regan, Mark M. 1962. A review of current national plans for land and water use. Journal of Farm Economics. Vol. XLIV, No. 5. pp. 1659-67.

Thomas, Robert W. and Timmons, John F. 1962. Land and its resources in a general demand structure. Mimeograph. Iowa State University.

AREA NO. 2. ECONOMICS OF WATER UTILIZATION

Problem. The efficiency with which ground and surface water resources are managed in the agricultural sector of the economy has a direct bearing on the productive efficiency of land and other national resources. Modest gains in the efficiency of agricultural water use will result in substantial increases in supplies effectively available for all uses, particularly in western regions where irrigated agriculture is an important segment of basin economies and water supplies are already inadequate for all beneficial purposes. Continued expansion of irrigation in the East and nationwide water pollution problems make the economic management of water in agriculture in most areas an important factor in balanced economic growth and the effective development of all water-using industries, including agriculture itself.

The economic analysis of agricultural water use and development in such a setting requires basic data on the adequacy of existing water supplies in relation to various economic uses; information about quantities of water likely to be diverted from agricultural uses by industrialization, urbanization, and related recreational needs; and knowledge of the extent to which basic water supplies might be effectively increased through saline water conversion and weather modification, small-scale technologies and practices for more efficient water distribution and application, and watershed management for optimum water yields.

PROGRAM

Current investigations are concerned both with providing economic facts on water supplies, uses, and management needs as they concern farmers, legislators, or administrators and with analyzing resulting implications for water management decisions. Intensive studies are concerned with developing economic principles and techniques appropriate to the analysis of agricultural water problems, complete regional inventories of water supplies and uses, and with the estimation of water values necessary for determining the feasibility and profitability of new water supply technologies or management practices, small watershed projects, and broad river basin programs. The work is discussed here under two subareas: (A) Inventory and appraisal of water resource supplies, uses, and values; and (B) Water requirements, allocation, and conveyance efficiencies. About 55 percent of the present USDA program can be termed basic economic research, with the remaining 45 percent representing applied economic studies and data collection necessary for both basic and applied studies.

Subject matter fields involved, in addition to economics, include hydrology, agronomy, engineering, statistics, and law. Aside from program leadership, about 35 percent of the research effort is centered in Washington, D.C. Major Washington studies include compiling, analyzing, and interpreting source

material on current and estimated future water use in relation to supplies, with particular emphasis on agricultural uses and their supply sources; developing improved techniques for evaluating watershed and river basin development projects; accumulating regional data on available land and water resources classified by productivity; and analyzing regional irrigation trends and potentials in the Eastern as well as the Western States.

State and regional water inventory and appraisal studies are currently cooperative with the Colorado and Oregon Experiment Stations; these deal primarily with estimating the value of water for irrigation and competing purposes in the Upper Colorado Basin and the Pacific Northwest. Water requirements, allocation, and efficiency research is cooperative with the Iowa and California Experiment Stations and on a contract basis with the University of Chicago. Cooperation in this subarea with Iowa on the economics of watershed management is largely informal, since major studies involving formal cooperation have been completed. The work with the University of Chicago concerns the factors affecting the use and occupancy of rural flood plains in the United States and also is nearing completion. Econometric models for joint land and water planning are being developed and the economics of land-forming techniques for water management in the East are being investigated in cooperation with the Iowa Experiment Station. A California cooperative project deals with the economics of large-scale water conveyance facilities for irrigation and related purposes.

Research effort in the economics of agricultural water use and development currently runs about 7.9 professional man-years. Inventory and appraisal aspects of the program (Subarea A) amount to 3.2 professional man-years. Water requirements, allocation, and management efficiency studies (Subarea B) involve 3.6 man-years. About 1.1 of a man-year is devoted to general program leadership. A line of work discontinued since September 1962 was a study of profitable farm adjustments to limited irrigation water in the Upper Colorado River Basin. A number of phase reports were prepared on this work, and cooperation with the Utah Experiment Station is continuing informally.

Regional research in which the Economic Research Service is assisting through committee membership and/or contributing projects includes work on water problems in the Southeast; a western regional project on the economics of integrated ground and surface water management; another western regional project on the economics of on-farm water use; a North Central project on the hydrologic characterization of small watersheds; and another North Central project on economic and legal factors in agricultural water use. In addition to assisting in planning the latter regional project, ERS is pursuing a contributing project on irrigation economics and provides the services of a regional coordinator.

PROGRESS

A. Inventory and Appraisal of Water Resource Supplies, Uses, and Values

In connection with appraisals of agricultural water use and supplies, special statistical studies have been made of census data on irrigated acreages for the period 1939-59 for each of the 22 mainland water resource regions as defined by the Senate Select Committee on National Resources and for Hawaii. Trend equations have been developed for each region, with associated data on their statistical significance as limited to the 1939-59 period of observation. The trend equation for the mainland 48 States indicates a constant 3.16 percent annual increase in irrigated acreage and explains 99 percent of the variance among periodic 5-year census estimates for the 1939-59 period. The equation for the eastern mainland shows a constant 8 percent annual increase rate and explains 92.3 percent of the variance, while the western mainland equation shows a constant annual acreage increase of 2.9 percent, and explains 98.6 percent of the secular variation. The region seeming to experience the greatest current rate of increase is the Lower Missouri, with a constant annual increase rate of 31 percent. Statistically, however, this rate is much less significant than the 15.2 percent increase estimated for the Chesapeake Bay region and increases for such other regions as the Upper Mississippi (13.8 percent), the Delaware-Hudson (12.6 percent), Western Great Lakes (10.3 percent) and the Upper Arkansas (9.4 percent). Work continues on relating these regional trends to various physical and economic limits on irrigation expansion, for the purpose of developing a series of hypothetical water-use projections keyed to alternative projective situations involving water-development, cost-price and legal factors.

The above research relates importantly to studies of humid area irrigation trends and potentials, and especially to an ERS study of irrigation trends and potentials in major water resource regions of the North Central States, a contributing project to a North Central regional study of legal-economic factors in agricultural water management and use. However, major efforts on humid-area irrigation have focused on completing a methodological study on the use of sample soil survey data for determining economic potentials for irrigation in North Carolina. Economic potentials of land for irrigation in North Carolina were established by four land classes that group soils in terms of relative likelihood of profitable response to irrigation. With the aid of soil scientists each soil series was assigned to a general irrigation class based on all crops to which the land is suited and into a specialized irrigation class for tobacco.

By use of the national sample of soils and land use, prepared as part of the Conservation Needs Inventory of the U.S. Department of Agriculture, acres of cropland and pasture were estimated for each irrigation class. Alternative estimating procedures were appraised and the method found most widely applicable was described and illustrated. Separate estimates were prepared for the Coastal Plain, the Piedmont, the Neuse River Basin, and for individual counties of North Carolina.

The total study area was found to contain some 8.4 million acres of cropland and pasture. About 3.3 million acres of this total fell in irrigation class 1; about 3.6 million acres were placed in class 2; 1.3 million acres were placed in class 3; and the remaining 0.2 million acres fell largely in class 4. The distribution of land by irrigation classes was found to vary considerably between the regions and from county to county. These and other results of the study are detailed in the report, "Economic Potentials of Land for Irrigation; An Exploratory Study of Soil Classification and the Conservation Needs Inventory for Area Estimates in North Carolina." The report is undergoing pre-publication review and revision.

Research on methods of estimating water values in agricultural and competing uses continues in cooperation with the Colorado and Oregon Experiment Stations. The phase of the Colorado studies dealing with the derivation of water values from farm sales data is near completion, with preparation of a technical bulletin detailing final results of a multiple regression analysis of 337 farm sales occurring in northeastern Colorado between 1954 and 1960. General factors most significantly related to sale prices were isolated as acreages of different land types, average annual water deliveries and capital improvements. An average annual supply of one acre-foot of water was valued at \$29 from farm wells and \$21 from surface sources. Separate sales of irrigation company stock in the area indicate a present value of \$29 per acre-foot of annual supply. Supplemental surface water brought into the area through the Colorado-Big Thompson transmountain diversion project apparently is valued at about \$26 per acre-foot of annual supply. The emergence of rural domestic water districts as a competitive force in the water economy of Colorado is also being studied in connection with water-value research in Colorado. Also, special research reports covering the associated use of water and fertilizer are nearing completion.

Progress in the first year of cooperative water-value studies in Oregon has included the initiation of water application experiments on field corn and bush beans as primary crops irrigated in the Willamette Valley. Both ERS and the Department of Agricultural Economics at Oregon State University have worked with the Soils Department in the design of these experiments. Concurrently, field data on irrigation inputs, responses, and enterprise combinations were accumulated in a survey of 20 percent of the approximately 400 farms in the Valley where one or the other of these crops are irrigated. The experimental results and survey data will be merged in formulating production functions from which demand or value schedules for irrigation water will be derived.

A study of farm adjustments to limited irrigation water in Utah has been terminated, with arrangements to cooperate informally with the Utah Experiment Station in the publication of reports.

B. Water Requirements, Allocation, and Management Efficiencies

Research on the characteristics and use of rural flood plains, carried out under contract by the University of Chicago, has been completed. A classification of rural flood plains was developed based on relationships between four selected physical factors (flood-plain width, slope of the adjoining land, flood frequency, and flood seasonality) and two selected aspects of occupancy (land use and structures). A number of physical and economic factors were tested in an exploratory attempt to find critical combinations of factors of maximum applicability in classifying and mapping rural flood plains. Alternative methods of collecting, coding, and storing flood-plain data were tested and evaluated. Plans are to publish the final report, "Rural Flood Plains in the United States."

Formal ERS research on the economics of watershed management has been limited to the analysis of crop-yield and hydrologic data from the Blacklands Experimental Watershed near Waco, Texas. The work is part of an effort to quantitatively evaluate and interpret in economic terms the results of hydrologic and agronomic studies at various Agricultural Research Service research locations--by deriving input-output functions wherein both crop yields and water yields (rates, volumes, probabilities) as multiple outputs are related to alternative watershed management patterns. Analysis-of-variance techniques are being used to first screen out the less important of a large number of relevant hydrologic and other variables. The remaining factors will then be subjected to a series of multiple regression analyses to formulate any usable mathematical relationships.

Economic Research Service watershed research in Iowa has been completed with publication of a final report on the relationship of alternative land management systems to the hydrology of the Spring Valley Creek watershed as covered in last year's report. However, ERS is informally providing assistance in the completion of similar experiment station research in other Iowa watersheds.

A major automatic data processing effort has been the accumulation of Conservation Needs Inventory data on current and projected irrigated acreages for each of the 22 major water resource regions of the United States, in addition to estimates of irrigation and drainage potentials as related to the productive capability and management requirements for different categories of agricultural and other land uses. The procedure has been to first aggregate CNI land-capability-unit estimates for each county into subtotals for 40 land capability subclass, class, and class-group designations within each of 114 State segments of water resource regions. The 114 series of partial totals were finally aggregated to water resource region totals. Machine tabulations for the State segments, as well as for each entire region, have been catalogued for research and administrative purposes, with plans to publish the summaries for each water resource region. This work is designed also to contribute ERS studies on the use of econometric appraisals of land resource development in the United States (see Area 1, Economics of Land Utilization).

Covered under the same project is work on water resource development through flood control, drainage, irrigation, and related land management problems in the Lower Mississippi Valley region. A complete survey and appraisal of current and impending needs for economic research in this area has been prepared and is undergoing pre-publication review. Reports are also in process on the economics of river bank stabilization and special cost-sharing problems related to public resource development in the Lower Mississippi Valley.

Cooperative research with the Iowa Experiment Station on the economics of land forming for water management in the Eastern States is nearing completion with a general report on (1) methods of classifying for economic research such practices as land leveling, grading, shaping, and special terracing techniques; (2) related requirements for engineering, water-control, and field operations data in completing realistic economic appraisals of each practice; and (3) an illustrated application of mathematical programming to the problem of determining economic feasibility of land-forming practices on a typical cash-grain operation in the Corn Belt, recognizing restricted availabilities of capital and other production inputs.

A complete report on the economics of planning large-scale water conveyance systems for irrigation and related purposes is also in process, in cooperation with the California Experiment Station. The report first presents a comprehensive economic model embracing such major design variables as the quantitative, qualitative, and locational aspects of projected water demands, quantities, and sources of supplies subject to conveyance; size economies for alternative system components (canals, tunnels, pumping stations, etc.); and the management objectives of planning groups as such. It then proceeds to a case study in depth of conveyance planning on the Madera Canal, an important component of the Central Valley project. The case study illustrates the practical application of the foregoing conceptual model and indicates the empirical significance of specific problems likely to be encountered in similar efforts. The final section deals with suggestions for the improvement of current planning procedures, drawing both from the model and the Madera case study. A paper on the "Pricing of Imported Water for Recharge in the San Joaquin Valley" presents economic arguments for using conveyance facilities immediately at full capacity—to recharge ground water until demands for direct design deliveries fully materialize.

In connection with improved methods for the economic evaluation of land and water resource development, ERS has participated in the preparation of two major Departmental position papers on (1) cost allocation and (2) cost sharing and reimbursement, both according to interagency standards set forth in Senate Document No. 97 in May 1962 by the President's Water Resources Council. The first statement sets forth a general policy position for the USDA on factors to be considered in developing mutually acceptable interagency practices for those water resource projects or programs requiring economic evaluation in accordance with Senate Document No. 97 and is the basis for USDA participation in interagency discussions of Federal policy on cost allocation.

The statement on cost sharing similarly relates to interagency discussions of procedures to be followed for water resource projects covered under Senate Document No. 97. Attention is given to the scope of USDA's interest in such projects; the objectives served by cost-sharing and reimbursement requirements; considerations in the division of financial responsibility between Federal and non-Federal interests; and a proposed grouping of project purposes into general cost-sharing categories.

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AREA NO. 3. LEGAL-ECONOMIC ASPECTS OF LAND AND WATER USE

Problem. Efficient allocation and use of land and water resources demands improvement in the laws, administrative measures and related institutional arrangements that prescribe the rules and procedures for transfer, use and management of land and water resources. Rapid rates of population growth, urban expansion, imbalances in agricultural supply and demand, and technological change, necessitate improved measures to achieve an orderly and balanced pattern of land- and water-resource development and use. For efficient resource use, additional information is needed on current status and innovations in water law, water-use and transfer arrangements; rural zoning and other land-use regulations; the organization and operation of resource districts and interstate compacts; property rights in land, including public acquisition of various easements and other property rights; and the impacts of public programs. Such information is needed and being requested by national and State legislators, farmers, and public and private agencies concerned with means of achieving economic efficiency in the allocation and use of resources. The number and complexity of demands for information and technical assistance in this area continue to increase rapidly.

PROGRAM

A continuing program of research is conducted to provide a systematic and continuing inventory and analysis of resource institutions and to focus on innovations in resource institutions permitting more efficient development and use of resources. The development and current status of statutes, constitutional provisions, and court decisions regarding water rights and associated laws in the 50 States are reviewed and analyzed, and attention given analyses of arrangements for transferring water rights and uses from lower-value to higher-value uses. Rural zoning enabling statutes and local ordinances are collected and analyzed with emphasis on the current status of, and recent innovations in, zoning. Consideration is given to the use of zoning arrangements for achieving the economical transfer of land resources from agricultural to nonagricultural uses. Enabling statutes and inventory data on special districts are analyzed as the background for further work on the economic efficiency of resource organizations used for developing and managing natural resources. Also analyzed are the feasibility of governmental purchase of crop-limiting easements as a production control and land-use adjustment device; impacts of public programs to control agricultural production; and farm impacts of such public projects as reservoirs and highways and methods for minimizing possible disruptive effects.

Research in this area is principally applied, although many phases of the program may be considered as basic. For example, much of the research on easements, innovations in water law and water rights transfer arrangements, new exclusive-type rural zoning, and efficiency criteria in evaluating resource district laws and administrative arrangements could be classified as basic research, although the usefulness of research findings in these areas also can

be both immediate and substantial. The nature and complexity of the research makes it necessary to draw heavily upon the scientific disciplines of economics, law, and political science, and to a lesser extent such disciplines as statistics, geography, engineering, agronomy, soils, animal husbandry, and forestry.

Approximately 6.5 professional man-years currently are devoted to this research program, distributed as follows: water rights and water legislation, 2.0 man-years; land-use regulations, 1.4 man-years; resource districts and organizations, 1.1 man-years; property rights and impacts of public programs, 1.7 man-years; and program leadership, 0.3 man-years. Federal researchers conduct their legal-economic studies cooperatively with personnel at the Agricultural Experiment Stations of Arkansas, Nebraska, Pennsylvania, and Wisconsin, and at the University of Wisconsin Law School. In addition, Federal personnel cooperate informally with many other researchers in other agricultural experiment stations and State universities and in State and Federal governmental agencies.

PROGRESS

A. Water Rights and Water Legislation

Studies of legal aspects of water rights in the East included the preparation of several preliminary reports on water rights in Wisconsin, Minnesota, Indiana, and Ohio cooperatively with the University of Wisconsin Law School under a contract with the Department. A formal cooperative arrangement was initiated upon completion of the contract to continue comparative analyses of the legal and economic aspects of water rights in the four States. Economic and related criteria were developed and employed to evaluate the water-rights laws studied. Constitutional questions, court-made and statutory laws of the various States, relevant roles of State and local governments and districts, and relevant Federal, interstate and international laws were analyzed. Field investigations were carried out to supplement library research and to answer such questions as how certain permit systems administered by State agencies have operated in actual practice.

The study has yielded much useful information on the actual operation of the applicable water laws. The findings indicate the need to fully understand the complexity of existing water law and water use conditions in a State before undertaking changes in those laws. The findings also indicate important differences in law and administration between States as well as between different areas within a single State. The preliminary manuscripts are being consolidated into five publications. There will be four separate publications dealing with the water laws in each of the States and one containing a comparative analysis of the laws of the four States.

The manuscript on Wisconsin water rights has been completed and is being edited for publication. It includes an extensive analysis of public water-use rights and the role of State agencies and local units of governments in

shaping water rights. Similar manuscripts dealing with Minnesota and Ohio are in process. A manuscript on water-use laws in Illinois has been completed. It describes and analyzes the reported Illinois court decisions and legislation, activities of State administrative agencies, river conservancy districts and water authorities, legal problems encountered by farm irrigators, and nonreported local court cases. It also reports the applicable Federal laws and programs, and the laws, decisions, compacts, and treaties regarding interstate and international matters affecting Illinois. The manuscript is being published by the University of Illinois.

Research is underway on a similar study of water laws in Arkansas in cooperation with the Arkansas Agricultural Experiment Station. A preliminary draft manuscript has been prepared.

Preliminary drafts of work on the origin and historical development of the riparian doctrine and the definition of riparian land have been prepared. These will be incorporated into a manuscript on water laws in the 31 Eastern States. A supplement to a comprehensive bibliography of publications on State water-rights laws and related subjects in the United States is now being prepared. Findings from Federal contract research and cooperative research have been used extensively by the non-Federal cooperators in various reports and publications.

The comprehensive review and analysis of legal aspects of water rights in the 19 Western States (including Alaska and Hawaii) was continued. Substantial progress was made in the preparation of a two-volume book on a comparative analysis of the water rights laws of the Western States. The project reviews the constitutional provisions, court decisions, and statutes underlying the State water policies.

A number of manuscripts were published in previous years summarizing the water policies of individual States. Recently, a separate report was published on the background and modern developments in water law in the United States. Current work updates the past publications and dwells more comprehensively on a comparative analysis of all the Western States. Aspects covered in detail include the historical development and present status of the appropriation doctrine and the fusion of the appropriation and riparian doctrines in some States.

Findings from the various water-rights studies indicate a wide variety of legislation has been enacted or is under consideration. Although some legislation has tended to clarify water rights, other statutes have led to some confusion regarding their application. A multiplicity of arrangements now exist that do not insure orderly and economical transfer of water rights and uses from low-value to high-value uses. Modification in administrative procedures or laws, or both, are needed to provide sufficient certainty or security to encourage desired investments in water-resource development and use while providing sufficient flexibility to safeguard public rights or interests. Studies of existing laws, alternative possibilities, and recent

innovations, and the collection, organization and analysis of pertinent physical, economic and related data are a prerequisite to informed judgments regarding improvements in administrative procedures and laws for development, allocation, and use of water.

B. Land-Use Regulations

Substantial progress was made on research on rural zoning required to revise Agricultural Information Bulletin No. 59, "Rural Zoning in the United States." A new bulletin in two parts is contemplated. The first part, rural zoning in the United States--zoning enabling laws, is now in draft form. Major provisions of about 300 rural zoning enabling statutes that authorize various governmental units or agencies to zone unincorporated or rural areas are described and reviewed. Results show rural zoning enabling laws exist in all 50 States. Generally, all or selected counties may zone in the South and West, towns in the Northeast, and both counties and towns or townships in the Lake States. Ten States empower selected cities and towns to zone for distances from 1 to 3 miles outside their boundaries. In 9 States, a beginning has been made with zoning at State levels.

Analyses have been made of zoning ordinances enacted under the enabling laws. Rural zoning ordinances have been passed by about 400 counties in 36 States and by more than 1,200 towns or townships in 14 States. Copies of zoning ordinances have been obtained from nearly 300 counties and from many towns. Tabulation and analysis of the provisions of county zoning ordinances is under way and detailed findings will be presented in a forthcoming report.

Findings indicate that in the past decade, rural zoning experienced major growth in the Central and Western Great Plains. Many new county zoning ordinances were passed. Districts zoned solely for agriculture and related uses, developed in California but a decade ago, are now found in more than a dozen States.

In recent years, a variety of new types of zoning districts for areas in the open country have been established. Among these are forestry, forestry-recreation, agriculture-recreation, watershed-recreation, flood plain, flood-way, conservation, wildlife, and open-space zoning districts and new kinds of agricultural zones. Zoning regulations, designed originally to serve urban objectives, are rapidly being reshaped to serve as major conservation tools.

C. Resource Districts and Organizations

Analyses have been initiated to provide an economic appraisal of local resource organizations. An inventory of the number of special districts concerned with natural resources has been started, and a manuscript is in progress. There are about 18,000 special districts in the United States of which some 7,000 are natural-resource districts. Comparisons of the number of special districts reported by various sources indicate wide divergence in the estimated number

of districts in existence. Accurate comparisons are difficult to make at this point because the legal definitions of what constitutes special districts as distinct from authorities or agencies of existing governments vary greatly from State to State.

A second area of analysis initiated is a detailed review of work completed by individual States on special districts within the States. Although several pamphlets on this topic have been published by legislative research councils of State legislatures and governmental research bureaus and other departments of State universities, no single document is available to briefly describe the bits and pieces of reported research on resource districts. Materials obtained from each of these agencies are being cataloged and will be reported in a bibliography.

The third stage of analysis initiated is a case study of the legal provisions for special districts in the State of Oklahoma. The statutes enabling different districts have been summarized and are being compared. Criteria are being developed for measuring the adequacy of existing enabling statutes.

D. Property Rights and Impacts of Public Programs

Research on the feasibility of easements and protective covenants for guiding rural land use was continued. Primarily, the analysis has centered on the feasibility of government purchase of crop-limiting easements. The easements would restrict production of grain and tilled crops on affected land but would allow other uses, including the establishment and use of permanent grasses. Landowners in six Nebraska counties were interviewed about their reactions to such a program and the payments they would require. Responses by landlords and owner-operators show that crop-limiting easements could be purchased for all time at less than the total land values. The probable average annual cost per bushel of net reduction in production (in corn equivalents) for different programs was computed. The crop-limiting easement approach showed definite and significant cost savings for the Federal government over two alternative lease-type programs examined. Easement prices based on per bushel of reduced production were lower in the less productive counties than in the more productive ones. Two manuscripts reporting these findings are now in process. Additional analyses are being made of likely community effects of an easement program, and minimum legislative authorities required to implement a program for purchasing crop-limiting easements.

Work on the specific effects of highway land acquisition on use of agricultural resources in Wisconsin has been terminated. Some of the findings are presented in a report on highways and adjustments in farms. A more detailed research report is in progress. The major portion of the work undertaken was directed toward answering questions about proper highway location in rural areas, and adequacy of procedures for acquiring farm properties, compensating owners and facilitating adjustment. Recommendations developed during the study, and now incorporated in Wisconsin land acquisition law and procedures, include directing appraisers to contact

owners; disclosing appraisal on which the offer is based; informing owners of their rights; protecting highway Commission's rights in acquired property; and simplifying appeal procedures. A major revision in both law and procedures now permits compensation of owners for some costs incurred in making necessary adjustments to highway takings.

Additional research is being conducted on the impacts of land acquisition procedures used by various Federal agencies that acquire land for Federal programs, or aid States in acquiring lands under Federally assisted State programs. This work is being done for, and at the request of, the U.S. House of Representatives Select Subcommittee on Real Property Acquisition of the House Public Works Committee.

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AREA 4. LAND TENURE

Problem. Improvements in the security, efficiency, and general well-being of rural people and others can be achieved through better tenure arrangements. At the firm level, research is needed to develop tenure devices which provide efficient, flexible, and expanding farms and rural enterprises. For guiding policies and programs, research also is needed to determine the effects of economic change on the adjustments in the relationships among resource owners and resource users and to determine the impact of various public measures on access to, and income from, resources.

PROGRAM

A continuing program of research is conducted which includes collection and analysis of data on basic land tenure changes and trends, patterns of land-ownership, forms of tenancy and other devices for resource control; analysis of the effects of leasing and other tenure arrangements on efficiency, scale of operation, investments, and the distribution of costs and returns; and analysis of the nature, relationships, and economic implications of changes in conditions under which farm and other land is acquired, held, and transferred. Consideration is given to the economic implications of land tenure arrangements and to the legal and institutional framework within which such arrangements operate. Much of the program is carried out cooperatively with the Agricultural Experiment Stations in several States and with Puerto Rico; the Agricultural Law Center, State University of Iowa; and with the regional research committees in the Great Plains, North Central, and Southern States.

The total professional man-years currently devoted to the area amount to 8.6 man-years, of which 0.9 man-year is devoted to program leadership. The remaining man-years are distributed as follows: basic information on tenure, 1.3 man-years; analysis of tenure arrangements, 3.7 man-years; and analysis of pattern and structure of resource ownership and control, 2.7 man-years.

During the reporting period, a research contract with the State University of Iowa on the legal-economic aspects of vertical integration and contract farming was completed. The economic analysis of farm tenure in resource use adjustment in Iowa was terminated upon the death of the principal investigator. The project on the relation of tenure arrangements and production control programs in the Southeast, direction of which was previously divided, was incorporated entirely into the tenure program of research.

PROGRESS

A. Basic Information on Tenure

Work continued on the development of basic information on tenure. A statistical summary of farm tenure changes in the Southeast was prepared for publication. The tenure data for 1940, 1950, and 1960 reveal the dramatic organizational changes that have taken place in southern agriculture. A decline of

over 70 percent occurred in the number of tenants and croppers, while all farms declined by 40 percent. An increase in the proportion of full and part owners between 1940 and 1960 indicates that owners are relatively immobile. From 1940 to 1960 the decline in number of croppers has been more rapid among white operators (from 139,000 to 31,000) than nonwhite operators (from 118,000 to 44,000). Differential mobility also is exhibited by the increasing proportion of older operators; between 1940 and 1960 the proportion of operators age 55 and older rose from 32 to 40 percent while the proportion of operators under 35 declined from 24 to 11 percent. Preparation of the basic data tables was a contribution of the Economic Research Service to the cooperative research sponsored by the Southern Land Economics Research Committee.

A comprehensive bibliography of land tenure and related topics for the years 1955-1961 is nearing completion. It contains over 500 entries of articles and books of use to researchers in land economics. Two other special-purpose bibliographies also are in process.

The graphic summary of farm tenure, published jointly with the Bureau of the Census, was completed and distributed. This report is similar to previous graphic summaries but contains a more extensive description of the relation of tenure to farm income, employment, mobility, age, residence, and farm facilities.

As a phase of a study of farm corporations being conducted in Iowa, an annual review of records of incorporation is made each year for the preceding calendar year. Approximately 325 farm corporations existed on December 31, 1962 in Iowa. A substantial proportion of these corporations have been formed since 1958. On the basis of a pilot study of farm corporations conducted jointly with the Internal Revenue Service and Bureau of the Census, a plan has been developed for collecting information on corporations in the 1964 Census of Agriculture.

Results of the Southeast landownership survey, reported last year, have been published. A study of cropland reversion in the South was made, based primarily on the Southeast ownership survey data. The study shows that a net increase of 905,000 acres of idle land has resulted from a change of 1.5 million acres of cultivated and woodland to idle, less changes from idle to cultivated woodland and urbanized land. Another study of the factors affecting the distribution of landownership, based on the Southeast landownership survey, has been initiated.

B. Analysis of Tenure Arrangements

Work on legal-economic aspects of farm tenure arrangements continued on land contracts, farm partnerships, and family farm transfer and operating agreements. A cooperative study of land contracts (purchase contracts) in Iowa has been completed and a manuscript reporting the findings is nearing completion. The survey, which included 154 buyers under land contract, was conducted cooperatively by the Economic Research Service, the Agricultural

Law Center of the State University of Iowa, the Farm Credit Administration, and Iowa State University. The study showed that the average down payment was 20.9 percent. Over the period analyzed, the long-term debt decreased significantly while the short-term debt increased. Financial progress, as measured by gain in net worth per year, was associated positively with class of farm, amount of operating capital, year the farm was purchased, amount of the down payment, and size of the operating unit and was associated negatively with amount of off-farm income and amount of the beginning net worth. Net farm income on these farms in 1961 was associated positively with size of the annual payment, type of farming, size of the operating unit, and amount of working capital and was associated negatively with size of the down payment.

The study of the legal-economic aspects of farm partnerships has been concluded. An article on partnership bankruptcy was published in the Iowa Law Review. A major publication on drafting farm partnership agreements has been prepared and presented for publication in the monograph series of the Agricultural Law Center. It discusses what should be included in the articles of partnership and presents various kinds of provisions that might be used to attain the desired relations. It also contains a sample form for a farm partnership agreement.

The current regional activity on family farm transfer and operating agreements was successfully concluded with the publication of a regional bulletin on family farm operating agreements. Nearly 75,000 copies of this publication have been distributed.

A book manuscript on the legal aspects of farm incorporation has undergone technical review. Details of contents were reported last year. The fourth phase of the Iowa corporation research, a study of the economics of farm incorporation, has progressed substantially. This study is devoted to a review of relevant economic theory and the application of linear programming to a selected respondent firm having multiple ownership of resources. The study will determine the effects of incorporation upon resource use and production efficiency, income distribution, tenurial stability of the corporate form, and intergeneration property transfers. Considerable progress has been made in construction of the legal-economic model for use in testing selected hypotheses. The model encompasses analysis of the firm simultaneously with analysis of each shareholder's personal estate.

A monograph on family farm corporations was published. The monograph contains the papers offered at a seminar held under the sponsorship of the North Central Tenure Committee. These papers cover the economic significance of the closed corporation in farming, legal aspects of the family farm corporation, and methods of research on farm corporations.

Analysis of the Self-Employed Individuals Tax Retirement Act of 1962 with implications for farmers was completed as an adjunct to the corporation research. The Act provides a limited opportunity to farmers and other

self-employed individuals to establish partially tax privileged retirement plans. Results have been published.

The legal-economic analysis of vertical integration and contract farming, performed under contract with the State University of Iowa, was completed. The project was carried out in three major phases, the first two of which have been reported. In the third phase, data from 420 farming contracts were summarized. A system of classifying contracts, based upon a scale ranging from an entrepreneur facing a completely open market to a totally integrated firm (open market = 0; total integration = 50), was used to evaluate the effect of various contract provisions. Average scores for various commodities ranged from 15 and 16.5 for rice and wheat seed contracts to 39 for pullets-from-chicks contracts. In addition to the summarization of the contents of vertical integration contracts, a book length manuscript on the law pertaining to contract farming has been prepared. Three model contracts also were developed.

Analysis of variance demonstrated that the classes specified in the scheme differed from one another by an amount more than could be accounted for by chance. A Guttman scalogram demonstrated that contracts cannot be adequately classified using a one-dimensional scale. However, factor analysis isolated four categories (factors) that accounted for most of the provision variance: ownership and supply of resources; decisions on operations; work-in-process risks, uncertainties, and liabilities; and final-products risks, uncertainties and liabilities. These four factors represented the minimal level of complexity (dimensions) for legal-economic analysis of the content of farming contracts and thus form the basis for independent variables in subsequent analyses.

Active participation in the North Central regional project on needed adjustments in land tenure to meet changing agricultural conditions (NC-53), has involved USDA personnel in several projects, particularly through leadership of the phase concerned with evaluation and development of new or modified tenure arrangements. This phase comprises studies of co-ownership (corporations, partnerships, trusts, joint tenancies), inheritance, fragmentation and consolidation, sharing control, credit agreements, attitudes and values (ownership, credit, occupation), and part-time farming.

C. Analysis of Pattern and Structure of Resource Ownership and Control

Research on the interrelations of tenure arrangements and production control programs in the Southeast continued. Preliminary budgets for tobacco farms and enterprises for the years 1922, 1928, 1934, 1936, and 1949 in the Virginia Piedmont and North Carolina Coastal Plains have been constructed to show changes in returns to labor and land over time. Emphasis is on comparisons between periods before and after initiation of the control programs. Results are not yet final but present indications are toward a relative increase in the proportion of return to land.

A study of the effect of the price support program for peanuts on sale values of farms in Bertie County, North Carolina, estimated a value of peanut allotment of \$669 per acre. High intercorrelation resulted in the deletion of cropland as an independent variable, so a part of the value of the allotment would include the effect of cropland without allotment. Byproducts of this analysis were estimates of the sale value of tobacco and cotton allotments, which were \$1,139 and \$463 per acre, respectively. These results were consistent with the results of similar studies in North Carolina and Virginia for tobacco and peanuts.

A manuscript has been prepared presenting the results of a study of the value of peanut allotments in Virginia. Yearly estimates of the value of an acre of peanut allotment for 1956 to 1960, inclusive, varied from \$429 per acre in 1956 to \$791 per acre in 1957. Although confidence limits of these estimates are wide, the results are statistically significant at the .01 level. A separate study of allotment estimating procedures resulted in a manuscript containing a comparison of three estimating models. Despite statistically significant results of estimating allotments apart from cropland, more precise results can be obtained for allotments and cropland combined.

Following a procedure similar to that used for tobacco, the marginal value product of an acre of peanut allotment on typical farms in Virginia is being determined and will be compared with the value of a sale price of an acre of allotment to calculate a capitalization rate for allotment purchase.

First phases of the analysis of land tenure problems and policies of Puerto Rico have been completed and substantial progress has been made on the remaining phases of the project. A manuscript on economic growth of Puerto Rico has been completed. Variables in the growth model include output and employment in the sugarcane production, other agricultural production, manufacturing, and government sectors; imports and exports; and investment and population. The period analyzed is 1947 to 1961--a period marked by a rapid real per capita income growth of 4.6 percent per year. Sectoral differences in growth were identified. Labor productivity, for example, increased at the rate of 9.3 percent per year in construction and manufacturing; 2.8 percent per year in sugarcane production; 7.1 percent per year in other agricultural production; and 4.5 percent per year in services and government.

The marginal productivity of capital was \$3.30 per dollar of capital invested, whereas the marginal productivity of labor was negative. Negative return to labor is not surprising in view of 10-percent unemployment. As productivity and wages rise, one of the chief advantages to Puerto Rican industry--low wages--may be lost. With few natural resources and dislocation from materials, the economy of Puerto Rico could face serious problems in the future.

Progress has been made on three aspects of the analysis of land reform in Puerto Rico. The historical study of the Land Law of 1941 and its subsequent modifications have shown the impacts of redirection in 1948 and 1950 toward the separation of welfare aspects of the law from the commercial and

development aspects. Approximately 50 to 60 percent of the corporate holdings exceeding the 500-acre legal limits had been acquired by 1950. Since then, practically none of the land held in excess of the 500-acre limit has been acquired by the Land Authority. Research on the productivity of resources in the proportional-profit farm system continues, using multiple-regression techniques. An analysis of the proportional-profit farm system as a source of capital for agricultural development is also being made. Special attention is being devoted to the management of reserve funds.

The relation between project reserves (or deficits) and wage and pricing policies is being studied. Development capital for the Land Authority comes primarily from rent and interest--rentals approximate \$1.2 million annually--so the pricing of land is a key factor in capital accumulation.

A study of the relative position of Negroes in landownership and resource control in the South has been initiated. First analysis will be based primarily upon secondary sources such as the census and the southeast ownership survey.

A cooperative study of the influence of institutional rigidity of operator labor on the distribution of income between land and labor has been initiated at the University of Illinois. This study will include development of a theoretical foundation for the treatment of factor returns and an empirical phase based on experience of Illinois farms. The study will contribute to the North Central regional research on tenure adjustment under changing conditions in agriculture.

An estimate of net farm income from data obtainable in the Census of Agriculture was completed. Results indicate that net farm earnings cannot be estimated accurately enough to provide a new economic classification that might substitute net income for value of farm products sold. The study concludes that far more detailed information is needed for an accurate net income classification of farms.

A working group was assigned to examine the impact of Agricultural Conservation Program practices upon supply management. Various approaches to classifying practices according to their expected output effects were explored. None proved very satisfactory due to the lack of research information as to the expected effect of practices in different areas. Greater use of the National Inventory of Soil and Water Conservation Needs in evaluating conservation achievement might be feasible. The inventory presently is used as an aid in allocating ACP regular funds among States.

Cooperative research under regional committees resulted in several major undertakings. These activities are not identified with regular research projects but do make a contribution to the overall program of work. Chairmanship of committees and subcommittees has afforded substantial direction to this work. Two new activities were initiated: (1) the preparation of a publication on research methods in land economics with emphasis on statistical

procedures, and (2) the identification and location of the entrepreneurial function in agriculture, a study in the control and structure of "agrindustry." A publication evaluating the scope and nature of tenure research was developed in cooperation with the regional committees and published by ERS.

Several activities related to foreign land-tenure problems, in addition to the foreign implications of the Puerto Rico project, continue to be part of the research and service program. In the past year, approximately two-thirds of a man-year of professional time was spent on consulting with foreign visitors, answering inquiries from international agencies, and contributing to the development of the Institute of International Agrarian Law. Assistance was given the Development and Trade Analysis Division in developing a P.L. 480 project on an economic evaluation of land reform in India.

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AREA NO. 5. IMPACTS OF URBAN GROWTH ON RURAL AREAS

Problem. Widespread shifts in land use are occurring as a result of technology and urban expansion. Growth of suburbs and new cities, expansion of transport facilities, developing demands for outdoor recreation as a leisure time activity and declining demands for land used in agricultural production are major forces whose impacts affect land uses on the rural-urban fringe. These developments give rise to many conflicts of public and private interests relative to appropriate uses of land. Others occur because resource owners and users have an inadequate understanding of each other's problems and needs. Research is needed to help find ways by which use adjustments can be made in an orderly and economically sound manner. Private landholders need help in adjusting their management to the developing of new opportunities in land use. Alternative enterprises such as outdoor recreation and new concepts of suburban development frequently can promote orderly resource development and use. Analyses of the impacts of urban expansion on the rural economy are needed to provide information to farmers, to other rural people, to affected urban people, and to policymakers for use in their decision-making.

PROGRAM

The program of research in the economics of urban impacts on land use currently is divided into two subareas: (A) Land-use adjustments on the rural-urban fringe, and (B) Outdoor recreation. This research appraises the overall national trends as well as regional, area, and special situations with respect to present and prospective changes in the use of rural land as this is affected by urban expansion and the changing urban demands competing with agriculture for land. Major nonagricultural land uses analyzed include the impact of urban expansion and location of new cities as well as transportation, industrial, commercial, recreational, and other developments. The characteristics of land resources, the requirements for outdoor recreation use, and factors involved in public or private ownership and management of land resources are analyzed. Techniques are developed for study of land qualities needed for open-space preservation for various purposes and studies are made to evaluate the economics of alternative land uses. Classifications of land qualities, characteristics, ownership patterns, and other factors meaningful for proper planning of resource management on the rural-urban fringe are made as needed to promote the overall research undertaking.

Research in this area is primarily applied, although portions of some undertakings might develop aspects that may be considered as basic. The applied nature of the research requires coordination of information drawn from several disciplines in addition to economics. Among these are sociology, psychology, geography, soils, forestry, crops and livestock management, conservation, statistics, biology, planning, and public administration. Research during the reporting period was formally cooperative with the Delaware State Agricultural Experiment Station. Informal cooperation is maintained with

many governmental agencies, several State experiment stations, endowed research organizations, and other organizations, as well as a few private individuals conducting research in related subjects.

Approximately 3.1 professional man-years were devoted to the overall research program in the economics of urban impacts on land use, including 0.5 man-year for program leadership. By subareas of investigation, personnel were committed as follows: land-use adjustments on the rural-urban fringe, 1.2 man-years, and outdoor recreation, 1.4 man-years. Approximately 0.5 man-year of this time was detailed to a task force assignment for study of resources and recreation in the Northern Great Lakes Region.

PROGRESS

A. Land-Use Adjustments on the Rural-Urban Fringe

A third publication resulting from study of land-use changes on the rural-urban fringe being conducted in cooperation with the University of Delaware was released in 1963. This provides an analysis of physical and locational characteristics found on tracts of idle land bypassed by suburban development. These tracts lie in the Wilmington environs in northern Delaware and comprise one segment of the ownership-land use classification study reported in 1962. Of the idle tracts lying idle in 1960, 66 percent had poor potential for immediate development due to soil conditions unsuitable for construction, absence of proximity to public services, and zoning regulations that presently preclude intensive kinds of urban-related developments. Several of the tracts lying idle also were being held for prices relatively high compared to others available for development. Of the idle tracts sold between 1960 and 1962, half brought less than \$400 per acre. Tracts in the area well adapted to development commonly commanded significantly higher prices.

Another report in process on land subdivision for suburban housing in northern Delaware presents an analysis of the recent rise in volume of subdivisions as urban populations move into former open country, the acreages involved in Delaware, and some of the problems both encountered and caused by developers. The need for comprehensive planning and effective controls was emphasized. It was noted that 12 percent of the land area outside incorporated places in northern Delaware was in housing developments. This was a fourfold increase since 1945. Assistance was provided in the drafting of model legislation to provide new regulations to help the local regional planning commission in its efforts to control suburban growth.

Other manuscripts in progress based on the research in Delaware involve a projection of the availability of open space in northern New Castle County, Delaware, to 1980 and a review of standards and criteria being used for open-space preservation.

A study of subdivisions in the mountains indicates shifts in type of development as developers gain experience with this kind of subdivision. Most plans originally were for weekend and vacation occupancy and recreational uses.

Significant numbers of buyers later decided to utilize the sites for retirement homes, others established permanent residences on the developments and commute to work. Others wanted additional kinds of recreational services. The changed intent for use has altered the outlook for these subdivisions. It also has brought new kinds of service problems to management as well as new opportunities to develop profitable service enterprises associated with the land-management activities.

A significant amount of professional time was spent on preliminary planning for a proposed study of ways to maintain agriculture on the rural-urban fringe of the Washington, D.C. metropolitan area. This study is an outgrowth of a request for assistance from the Joint Open Space Project Committee of the National Capital Regional Planning Council. Results from this study should have broad application in the environs of all growing urban areas and may well provide new approaches for agricultural programs.

A reconnaissance was made of planning activities in California related to preservation of agricultural land and continuation of agricultural production as suburbs, new towns, transportation, and other uses grow into rural areas. Preliminary findings are that: (1) zoning has limitations as a means for preserving agriculture in the rural-urban fringe; (2) a few large real estate developers are making a conscious effort to locate housing and services in such a way that open-space amenities will be preserved, with success dependent primarily on costs and returns involved; (3) one major cost factor in preserving open space involves future public real-estate assessment and taxation policies and practices; and (4) new methods of keeping productive agricultural land in agriculture or other open-space uses still are needed. Plans are to undertake further investigations in depth, both in California and in other parts of the Nation.

B. Outdoor Recreation

Studies on the economics of outdoor recreation included publication of a report on farm vacations in East Central Ohio. Both the Federal Extension Service and the Farmers Home Administration are using this publication extensively in their programs. Some additional fieldwork has been conducted to supplement the original study and a revised and updated publication is in process. The study indicates that (1) providing vacation facilities for nonfarm people can help some farm families supplement their incomes, (2) new investments needed to start in the business often are fairly small, (3) more families are attracted to this kind of recreation than single individuals, (4) both guests and hosts benefit from the experiences, (5) the business can be developed best in areas where several families provide such facilities, and (6) income thus created is spread among businesses operating throughout the community. Fieldwork has been completed for a companion study of farm vacations in New England and a report is being prepared.

A survey of resources and recreation in the Northern Great Lakes Region absorbed the time of one senior researcher for approximately six months. Issued as a Department of Agriculture Task Force report, this study examines the opportunities for rural area development in an 81-county area roughly equivalent to what formerly was called the Cutover Area of Minnesota, Wisconsin, and Michigan. A series of recommendations were made for public programs, including multiple use of resources with particular emphasis on opportunities for developing additional outdoor recreation activities. This report provided a basis for the special Lake States Land and People Conference held in Duluth, Minnesota, in September 1963.

Considerable service has been provided government agencies and individuals through information based on technical knowledge of professional personnel gained from previous studies, work under way, or from associations with others involved in related work.

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AREA NO. 6. ECONOMIC DEVELOPMENT PROBLEMS AND
PROGRAMS IN RURAL AREAS

Problem. The economy of many rural areas is not expanding as rapidly as the national economy nor as rapidly as the increases in population. In many cases the local economy may even be shrinking. Incomes of the people in many rural areas are still declining in relation to national levels. Numerous public programs have been devised to cope, in part or in whole, with this problem. There is a need for analysis of the problems that create low-income situations, and evaluations of various public programs and other measures designed to stimulate economic development and assist local and area efforts.

PROGRAM

Research in this area is concerned with determining the nature of the economic problems associated with low-income rural areas, the measurement of the effects on local economies of levels and trends in economic growth, and the evaluation of programs at the various levels of government in stimulating economic growth. Research is principally applied, although particular segments may be considered as basic research.

In Washington, D.C., the work is concerned primarily with analysis of secondary data to determine for counties and areas the levels of family and per capita incomes and changes in levels of income by economic groups. Local studies are conducted usually in cooperation with State experiment stations to determine the nature of the problem, to measure progress in economic development, and to evaluate the factors associated with that progress. In Michigan a determination is being made of the factors affecting the ability of farm people to compete for nonfarm jobs, and the effect of the different rates of economic growth on the ability to obtain nonfarm jobs. In Oregon, Missouri, and South Carolina, the various factors influencing the future development of an area are being studied. In Ohio a study is under way to appraise the opportunities for outdoor recreation enterprises on farms. In Indiana a study is under way to determine the place of formal training and education as a means of providing more job opportunities for workers in low-income rural areas. In local areas of Arkansas, Kentucky, Mississippi, Oklahoma, South Carolina and West Virginia, studies are under way to measure the impact of Area Redevelopment Administration grants and loans on local economies and provide current information of value in administration of the programs. In Arkansas, Missouri, New England, Ohio, Oregon, and South Carolina, studies have been recently completed or are nearing completion, to determine the nature and economic success of recreation enterprises on farms.

At present 11 professional man-years are devoted to this area of research, including 5 man-years devoted to economic development and adjustment problems, and 6 man-years to the evaluation of proposed rural development programs.

PROGRESS

A. Economic Development and Adjustment Problems

The plans for the study of the dynamics of physical and human resource use in selected low-income areas of New York, Virginia, and West Virginia, were developed and the field enumeration is nearing completion. Preliminary observations are that these areas are in the late stages of transition from farming to nonfarm employment. The areas retain a considerable portion of the population which tends to concentrate on the relatively few hard surface roads. Frequency of moving from one type of nonfarm work to another nonfarm job is especially high among those who lack skills needed in nonfarm work. Especially among the older people, transfer payments are an important income source.

A study of two labor markets in Michigan revealed that employers do not discriminate between farmers and nonfarmers as a source of labor supply. Farmers were well informed on off-farm employment opportunities within the local area. They were not particularly interested in additional training that might improve their income. The kind of occupational information most needed appears to be the changing trends in kinds and numbers of occupations and the attendant requirements for qualification.

Data collection is nearing completion and analysis has been started on a study of training and education as a means of providing more job opportunities in a low income southern Indiana County. Preliminary analysis indicates that individuals in the area have aptitudes that are comparable to those of other areas. Differences in characteristics of employed persons and unemployed persons is an indication that education is an important factor in obtaining and retaining employment. There is also some preliminary information to indicate that the kind of education received does not permit substantial groups of individuals to seek employment in other areas, except in unskilled or semiskilled occupations. Employment opportunities are declining relative to the size of the labor force in areas where the labor force has limited training.

B. Evaluation of Proposed Rural Development Programs

A study of farm oriented recreation enterprises in six areas of the country to provide data for action programs on volume of patronage, capital requirements, costs, returns, etc., is nearing completion. An Arkansas study indicated that the resources in Arkansas' rural areas are adaptable to the development of recreation enterprises. The characteristics of the people, the land, the water resources, and the investment capital, make the development of rural recreation enterprises a feasible alternative use for these resources. The returns to family labor and management from many of the rural recreation enterprises were probably more favorable than many of the alternative employment opportunities in Arkansas' rural areas. However, few of

the rural recreation enterprises of the 13 types studied provided the sole support of the operator and his family. About 54 percent of the enterprise operators had plans for expanding their facilities. Expansions planned by dude ranch and float-trip-fishing operators indicated the greatest potential effect on employment. Approximately 68 percent of the businesses were used to capacity during the peak quarter of the year. Sixty-two percent of the enterprises were operated in conjunction with farm units, and in about 60 percent of these cases the enterprise was considered truly complementary.

A manuscript reporting the results of the study of the recreational operators in the Ozarks of Missouri on income potential of various kinds of recreational enterprises in Missouri is being prepared for publication. It was found that many of the recreational enterprises that have been undertaken by farmers in Missouri as a primary source of family income have not been financially successful. Reasons for this condition include: limited previous experience; insufficient patronage, with most farmers catering to less than 30 percent as many patrons as could be handled during the peak recreational season; inadequate advertising, with word-of-mouth about the only advertising method followed; and unattractive accommodations with little time and money spent in making facilities attractive to guests. Scarcity of credit was not found to be a factor that limited the expansion of the recreational enterprise for most operators. Only an occasional operator indicated an interest in borrowing funds if they were available at 4-percent interest.

The successful recreational ventures had the following characteristics: The operator had specialized training in the undertaking before he assumed full responsibility for the enterprise; the facility was in a good location; the initial operation was of sufficient size to require the operator's full-time effort; and the operator had correctly forecast the demand for his type of facility.

Several methods were followed to limit or transfer liability, including warning of dangerous conditions, exclusion of unwanted guests, incorporation, and transfer of liability through insurance.

A manuscript has been prepared for publication on private outdoor recreation in western Oregon. Of the 41 recreation enterprise operators interviewed, 17 were also farming, 5 considered themselves retired, 11 worked full time at the recreation enterprise, 6 worked part-time at another nonfarm job, and 2 were church-operated. Investments in recreation vary greatly with type of enterprise. Operators selling fish bait required little investment. Those selling hunting rights had no investment in addition to the land used primarily for other purposes. Yet others, as operators of ski areas and riding stables, had made substantial investments. Returns to recreation enterprises generally were low. This was attributable in the largest measure to the lack of customers. The nearby public facilities are frequently important to the success or failure of a private enterprise. Public facilities may draw

customers to a riding stable yet compete with private camping grounds. Customers generally made use of more than one type of recreational facility during each visit.

A recreation enterprise study in Ohio revealed that there are about 250 outdoor recreation enterprises in the 23-county study area which are of types that might be established on farmlands with private capital. Findings are based on case studies of 30 such firms: 5 pay lakes, 7 vacation farms, 4 shooting preserves, 4 riding stables, 3 organized camps, 3 privately owned picnic areas, and 4 camping areas. Twenty-six firms showed a net return to labor and management before deduction of interest charges. Fifteen firms showed a net profit after deduction of interest on investment. Land is generally the largest inventory item, especially for shooting preserves, riding stables, and private picnic areas. Most firms are sole proprietorships and are owner-operated. Location is a major factor determining the size and success of recreational enterprises. The seasonal nature of most types of recreational enterprises and the uneven patronage patterns (high weekend participation) were found to be major economic problems.

Over one-third of all firms borrowed money for their recreational enterprises and about one-third have plans for further expansion. Most of the operators with plans for expansion indicated that they would take advantage of a low-cost public loan program. Credit for recreational development and expansion is relatively difficult to obtain in the study area. Word-of-mouth was the most important type of advertising. Outdoor signs, brochures, newspaper advertising, and direct mail were also important. About 80 percent of all firms carry liability insurance. Although recreational development appeared to be a good land-use alternative in the study area, the large percentage of unsound businesses indicates that careful planning and good management are necessary to the success of recreational enterprises.

Data for the New England recreation enterprise study were obtained from operators of recreational enterprises in five of the six New England States. Most of the operators of recreational enterprises were not actively engaged in farming. Many were former dairy farmers who had been operating near the margin of profitability. Concurrently, they seek off-farm employment. Major problems faced by operators of recreational enterprises were: operating too small an enterprise to be profitable, labor costs too high in relation to income, and credit not readily available at low cost.

During the year a study was begun through the use of Area Redevelopment Administration and ERS funds to study the impact of ARA loan and grant funds on local economics in six areas in Arkansas, Kentucky, Mississippi, Oklahoma, South Carolina, and West Virginia. The current phase of the work is to obtain benchmark data as a basis for measuring change over time and also to provide current analysis of the program for use in administration of the program.

As a part of the service provided the Rural Areas Development Program and the Area Redevelopment Program, a manuscript has been developed from Census of Population data containing county median incomes, county income ranks, and changes in ranks over the past decade. These data are used in determining counties eligible for financial assistance under the Area Redevelopment Act. These data also will be used in further investigation of income and development problems.

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AREA 7. INCOMES, EMPLOYMENT AND RESOURCES
OF PEOPLE IN SELECTED RURAL AREAS

Problem. Rural people, particularly rural farm people, bear a disproportionate share of the low-income problems of the Nation and are confronted with difficult adjustments in resource use. Rural people are not, however, a homogeneous population with respect to either present levels of income and economic development or the nature of possible and desirable adjustments in the use of resources.

There is increasing need for research designed to develop and organize data into analytically functional patterns indicative of the interrelationships between income levels and measurable characteristics of the human agent and other resources by economic activity sectors and geographic areas; and analyses to discern particular relationships that have significant implications for policies and programs designed to facilitate resource adjustments and ameliorate underemployment and low incomes.

PROGRAM

The research program on the general problem has two primary parts: (A) Analysis of characteristics and uses of resources as related to income; and (B) Appraisal of adjustments in the combination and use of resources. Research in both areas is principally applied, although particular segments may be considered basic. The research concerning resource-income characteristics is conducted both in Washington and at a field location in cooperation with the North Carolina Agricultural Experiment Station. The principal efforts in this subarea are: to develop and organize data concerning incomes and resources of rural people and areas in patterns or classifications, the analyses of which will shed light on the interrelationships existing between income levels and the nature and utilization of resources for economic activity sectors; and to develop and test methodology and measurement techniques for quantifying observed or hypothesized relationships between income levels, changes in income over time, and specified characteristics and uses of resources.

The research program of the subarea on resource adjustments is conducted primarily from field locations in cooperation with agricultural experiment stations in the States of Florida, Mississippi, Missouri, Oregon, Tennessee, Texas, and Virginia.

The principal objectives of this research subarea are: to determine and evaluate adjustments in resource use that have been made by farm and other rural people having designated attributes and resources in particular areas over specified time intervals and under specified general local and national economic conditions; and to evaluate alternative adjustment possibilities for these people and areas.

During the reporting period 10 man-years of professional time were devoted to this area of research. About 5.5 man-years were employed in subarea (A) and 4.5 in subarea (B).

PROGRESS

A. Analysis of Characteristics and Uses of Resources as Related to Income

Analysis is under way of data resulting from a matched sample of about 9,000 Census of Agriculture and Census of Population and Housing questionnaires. The resulting information relates level and source of income and housing, population and family composition information with size of business and physical resource characteristics and utilization of farms.

Another aspect of research in this subarea resulted in the development of an operational concept of economic underemployment and of a technique for measuring in quantitative terms the unemployment equivalent of economic underemployment for specified population groups. Estimates have been developed of the unemployed equivalent of economic underemployment for age-sex-residence groups of the rural population between 20 and 64 years of age. Similar estimates were developed for all males over 25 years of age for 13 southern States, and for 3 age groups of hired male farmworkers who worked 150 days or more at farmwork.

Other related research has been directed toward determining economic factors that are associated with differential levels of educational attainment and aspirations of rural farm youths. In general, the greater concentration among farm families of relatively low levels of income seems to explain most of the observed differential between farm and nonfarm youths with respect to level of educational attainment and aspirations for continuing training beyond high school.

In a cooperative study with North Carolina State College further research has been carried out to develop a technique for measuring the extent of changes over time in economic underemployment by size of farms in different regions. This analysis covers farms by economic class for each of 23 economic subregions in 4 States: Arkansas, Indiana, Iowa, and North Carolina.

B. Appraisal of Adjustments in the Combination and Use of Resources

Studies in this subarea are designed to describe the nature and evaluate the results and implications of adjustments made in selected problem areas in the use of economic resources.

In a study of farm adjustments associated with nonfarm employment in the Blackland Prairie area of Texas it was found that the average money income of the area's rural farm families was \$3,684. Of this sum, \$1,893 was net cash farm income, \$1,377 was from off-farm work, and \$414 was from other

sources. The cash income of nonfarm rural families average \$2,662. A wide variation in income was found as one-third of the farm families, and nearly one-half of the nonfarm families received less than \$2,000 in 1959. Almost one-half of the farm families and one-third of the farm operators reported income from off-farm work.

Low income was closely associated with advanced age of family heads, low levels of education, and physical disability. Nonwhite and sharecropper families usually had below average incomes in the area. Of all rural farm families, about 30 percent appeared to have considerable potential for income improvement.

In almost all analyses, younger family heads (those under 45 years) appeared to have an advantage both in current incomes and in opportunity to improve incomes. Young farmers had larger acreages to farm and also took greater advantage of off-farm employment than did older farmers. Among nonfarmers also, young family heads had higher earnings and accounted for a larger proportion of family incomes than did older family heads. The increasing age of farm operators (the average age was 52.2 years and almost three-fourths were over 45) suggests that additional land resources may be released in the next few years. If rates of entry into agriculture remain at current low levels, farmers who remain in agriculture may have an opportunity to increase the size of their farms and raise their incomes.

Another aspect of the study was development of 1970 projections for the Blackland area. Farm numbers by age of operators, by tenure, and by size of farm were projected, as were farmland and cropland acreages. Age-cohort analyses assuming 1940-50 patterns, projected a decrease in farm numbers of 43 percent from 1959 to 1970. No tendencies for trend reversal were found. The proportion of farms, farmland and cropland harvested under full owners and part owners is expected to increase. Only one-sixth of the farm operators are expected to be full tenants.

The average size of farm was estimated at 415 acres for 1970. Only farms of 260 acres and over are expected to be more numerous in 1970 than in 1959. A large number of distributions were developed using age of operator, tenure, and farm size in cross-classifications. The opportunity for increased incomes on the fewer but larger farms appears to be quite favorable unless the trend to bigger operations is offset by smaller price-cost margins.

In a study of adjustments for low-income farm families in the Clay Hills area of Mississippi it is concluded that farm operators are making adjustments in resource use as rapidly as possible without concentrated assistance. The problem here is mobility of resources in addition to the usual firm adjustments. It includes ways of facilitating desirable farm enlargement through arrangements such that idle crop and pastureland can be rented by commercial farm operators; and means of obtaining an improved level of forest management on farm woodlots that will make a contribution to family income.

A linear programming analysis is being made in cooperation with the Mississippi Agricultural Experiment Station of the adjustment potential of present farms in the Clay-Hills area with current technology and farm size. Partial budgets for the linear programming analysis have been completed and published as a progress report. The preliminary results indicate that reorganization of resources on small farms with present technology (20 acres of cropland) would increase farm income only slightly, from \$1,043 to \$1,314. This would still leave the small farms in a low-income condition if \$2,000 is used as an acceptable income level. On the other hand, resource reorganizations on medium (40 acres of cropland), and large (75 acres of cropland) could materially increase incomes on these farms. For example, on large farms the increase in income would be from \$3,644 to \$4,241. In each farm size the cotton enterprise would come into the optimum farm plan to the full extent of the allotment.

The Clay-Hills area of Mississippi during the 1950's had a net out-migration of 88,500 persons. However, there was only a 9-percent decrease in the population. The number of employed persons in the area decreased by 12 percent between 1950 and 1960. Agricultural employment decreased by almost 60 percent, but the number employed in manufacturing increased by 47 percent. During the decade, 1950 to 1960, 17 of the 18 counties in the Clay-Hills lost population. However, since 1960 it is estimated that 11 counties in the area have gained population. There has been a net in-migration of whites and a considerable slowdown in the rate of out-migration of nonwhites. Additional job opportunities in the area have been responsible for the reversal of the earlier trend.

A study of adjustments in the use of resources on low-income farms in a 13-county area of western Oregon is under way. Work has been completed on the field enumeration in all of the study counties. Schedules were obtained from 2,346 respondents living in the rural areas. Of those responding, 1,462 (62.5 percent) obtained their income from off-farm activities and received no income from farming. The remaining 880 respondents (37.5 percent) obtained some of their income from farming. A detailed farm-oriented questionnaire was obtained from 207 respondents. These were persons whose gross farm sales in 1961 were more than \$250 but less than \$10,000, or who worked less than 200 days off the farm, or earned less than \$4,000 from off-farm work.

In Tennessee a report is in process of publication which details the results of analysis of the economics of farming systems for conservation on typical low-production farms. The results of this study suggest a general relationship between the intensity of use of practices for conservation and current income. More intensive application of practices raises the farmer's current income if he has a low level of use; but as intensity increases beyond a certain level, benefits decrease. It follows that there is an optimum economic level of practice intensity from which either higher or lower levels will reduce current net income to the farmer.

Of the three levels of practices for conservation studied, both the full-time farmer and the part-time farmer would select the highest level only if some payment from outside sources could be used to offset his reduced current income from the farm, or if there were some noneconomic benefits.

The part-time farmer might rationally choose either the low- or medium-level of practices for conservation system, depending on whether emphasis is placed on total returns or returns per unit of resources.

PUBLICATIONS

A. Analysis of Characteristics and Uses of Resources as Related to Income

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B. Appraisal of Adjustments in Combination and Use of Resources

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AREA NO. 8. RURAL AREA ECONOMIC STRUCTURE
AND ECONOMIC GROWTH

Problem. The income and welfare position of rural areas is increasingly dependent upon the relationship of agriculture to other sectors of the economy. In the process of economic growth the economic structure of rural areas is continually changing, as is the relationship of rural and urban areas. Increased knowledge of the interrelationships between the structural characteristics of the rural economy, rural-urban interdependence, and economic growth are of vital importance for policy and program decisions. There is a need to explore these interrelationships and appraise development program alternatives with a view to maximizing the income and welfare position of rural areas.

PROGRAM

The program of research may be subdivided into two subareas: (A) Intersector relationships; and (B) Appraisal of growth potentials. Although substantial segments of the program of work may be considered basic research, the results have immediate implications for guiding adjustment and development programs. Research is under way on the relationship of urban and industrial development to low incomes in agriculture; the effects of national economic development upon the development of low-income rural areas; and the appraisal of growth potentials in rural areas. Some effort is also devoted to developing methodology for measuring these potentials.

Work in Washington, D.C. is concerned primarily with the analysis of secondary data to determine levels of economic growth, manpower utilization and capital availability, as they relate to county, city, State, and national economies. Research is being carried out in North Carolina that relates local low income farm-area development with national trends. In South Carolina work is under way in evaluating alternative development opportunities in that area. A new study analyzes the factors affecting economic development in the Appalachian Region.

At present, 6 professional man-years are devoted to this area of research, including 3 man-years devoted to intersector relationships and 3 man-years devoted to appraisals of growth potentials.

PROGRESS

A. Intersector Relationships

A study of underutilization of rural manpower was developed in connection with an evaluation study of the Manpower Development and Training Act. This study estimated the existence in the United States of 713,000 persons within the eligible age limit who are members of farm-connected rural families with family incomes of less than \$1,200, and are thus eligible for retraining

benefits under the Manpower Development and Training Act. In 1961 this would have amounted to 15 percent of the total number of persons reported as unemployed by conventional definition. Considering members of farm families who have incomes of less than \$1,200 as unemployed (as the Manpower Development and Training Act provides), would result, for some States, in total unemployment estimates more than double the number obtained by using the conventional definition. In a study of manpower development in the South it was found that the investment of resources in retraining low-income rural people would readily be paid off. The study also showed that in many southern States a year's training could be justified on economic grounds alone, even for persons up to 60 years of age.

A study of the economic bases and potentials of rural communities examined in detail the historical significance of agriculture in America's economic development. An analysis of county groupings on the basis of size of the major community found adverse relationships for income, population, and governmental expenditure variables. In addition, the study intensively analyzed capital availability in rural areas from the point of view of type of financial intermediary, as well as from the historical point of view. It further examined the volume of new capital expenditures, transfer payments, and the location and ownership of wealth. The analysis demonstrated the adverse position of rural areas from the point of view of utilizing capital mechanisms to maintain or accelerate their own economic growth.

B. Appraisal of Growth Potentials

Research in this subarea is largely new work. A study was started during the year to evaluate the alternative development opportunities in low-income rural areas of South Carolina. Plans are being developed for appraising the economic potential of an underdeveloped area of South Carolina to evaluate the essential attributes for economically viable areas, and to develop guides for appraising the economic feasibility of alternative public and private investment in rural areas.

Work was also begun during the year in Pennsylvania and West Virginia to analyze economic development potentials in the Appalachian Region. The initial research to assess Appalachia's economic potential is of an historical, economic, and geographic nature. Trends in the level of activity in all major industries and services of the region are to be noted and analyzed to identify factors that appear to have been instrumental in recent growth or contraction in the region as a whole and its subregions.

PUBLICATIONS

A. Intersector Relationships

- Bachmura, F. T. 1963. Agricultural unemployment and underemployment and government program approaches. Prepared for delivery before Methodist Conference on Economic Issues in Agriculture, Washington, D.C.
- Bachmura, F. T. 1963. Conditions conducive to economic development in local areas. Prepared for delivery before the Eleventh Annual Farm Business Training Conference, Stillwater, Oklahoma.
- Bachmura, F. T. 1963. Manpower retraining in the south's rural population--an opportunity for development. Prepared for delivery before Association of Southern Agricultural Workers, Memphis, Tenn.
- Bachmura, F. T. 1963. The manpower development and training act of 1962--its significance for rural areas. Jour. Farm Econ. Vol. XIV.
- Southern, J. H. 1962. Implications of population and occupational change for rural areas development. Talk given at 40th Annual Agricultural Outlook Conference, Washington, D.C.

B. Appraisal of Growth Potentials

- Bachmura, F. T. 1963. Development commissions in communities. Yearbook of Agriculture.

AREA NO. 9. ECONOMIC FRAMEWORK AND CRITERIA
FOR RIVER BASIN AND WATERSHED DEVELOPMENT

Problem. The Senate Select Committee on Natural Water Resources in its report of January 1961, recommended the development of comprehensive plans for all major river basins by 1970. Formulation of comprehensive plans for use and development of river basins requires the establishment of an adequate framework of economic data, projections, and systems of analysis; and the application of appropriate evaluation standards and concepts. Such considerations as the large capital investments being made by public agencies in water-resource projects, the pressure of an expanding economy on the available resources, existing underemployment of resources, the need for production and income stabilization and advancing technology, emphasize the need for economically sound comprehensive river basin plans.

Future use and investment in the development of water and related land resources should be shaped by regional and national considerations as well as local needs and desires. To achieve these objectives, economic research is required to relate the potentials of various basins and their relative economic efficiency to emerging national and regional requirements and goals. Furthermore, continuous reappraisal is required to evaluate the changing pattern of technological development and consumer preference, and to relate these changes to the potential supply and demand of natural resources.

PROGRAM

Current activities are concerned with these subareas of investigations: (A) Standards and practices for economic evaluation and program formulation; (B) National-regional data framework on the supply, use, and productivity of agricultural resources; and (C) Basin needs, problems, patterns of resource use and potential for development. These activities provide a basis for the evaluation of agricultural elements of a river basin's economy within the framework of national requirements and production prospects. Program emphasis is on applied research although particular segments of the program may be considered as basic research. The research is carried out through five field program offices and in Washington, D.C. The field locations are: Little Rock, Arkansas; Stillwater, Oklahoma; East Lansing, Michigan; Upper Darby, Pennsylvania; and Logan, Utah.

The research activities are carried out under provisions of a memorandum of understanding, between the Soil Conservation Service, Forest Service, and Agricultural Research Service, dated February 2, 1956 (ARS responsibility subsequently transferred to the Economic Research Service), and through cooperative agreements with the Corps of Engineers, Public Health Service, and other public agencies. Activities are financed through transfer funds from these agencies.

A total of 10.0 professional man-years are devoted to the area as a whole. By subareas of work, professional time is allocated as follows: general standards and practices for economic evaluation and formulation, 1.0 man-year; national-regional data framework on the supply, use, and productivity of agricultural resources, 2.0 man-years; and regional needs, problems, patterns of resource use and potentials for development, 7.0 man-years.

PROGRESS

A. General Standards and Practices for Economic Evaluation and Program Formulation

Work continued on the development of improved evaluation and formulation standards and practices for water-resource programs through participation on inter and intradepartmental task groups. Activities of these groups resulted in the preparation of reports for administrative use on: the evaluation of recreation and fish and wildlife benefits of water and related land developments; and national economic growth projections for 1980, 2000, and 2020.

B. National-Regional Data Framework on the Supply, Use, and Productivity of Agricultural Resources

A study nearing completion provides the statistical base for normalized agricultural production and price relationships. The study involves the tabulation of crop and production data for a period from 1939 to 1962, by States. These tabulations have been completed for 80 commodities. Factors included for each crop are total production, sales, price, and value of production. Factors included for livestock are sales, production, price and value of production. Estimates of normalized production and price relationships are being derived from mathematically fitted trend lines. This procedure provides a set of estimates of prices which reflect current production practices and current technology. The abnormalities caused by weather and other hazards are removed from the trend line. By application of these values to other data derived from field studies, such as production data, a balanced set of economic relationships is maintained. When supplemented by additional data on acreages and livestock numbers, analyses may be made of the changes that have been occurring in agricultural production and the proportionate contributions of major agricultural regions to national production.

Estimates of future regional requirements for agricultural products are being developed in cooperation with other Divisions of ERS. The projection of national food and fiber requirements are based on specific assumptions in regard to such factors as population growth, consumer income, consumer preferences, exports and imports, and per capita consumption. National requirements are allocated to 10 regions. These allocations are based on such factors as historical contribution of regions to the total product requirement, and losses or gains in the resource base of regions. Simultaneous allocations

of the national requirements to regions establishes estimates of regional product requirements which are consistent with the national food and fiber needs. Such allocations provide sets of goals which should be considered in the evaluation of program or project plans.

C. River Basin Needs, Problems, Patterns of Resource Use and Potential for Development

Work is continuing on the study of the agricultural elements of economic base studies of the drainage areas of the Susquehanna-Chesapeake, Ohio, New England and Upper Mississippi Rivers. ERS studies include: (a) classification of soils according to productivity, including information on production practices, technology, costs of production, and land use; (b) projection of production estimates; (c) projection of competitive uses of land such as urban, industrial and other nonagricultural uses and the effect on the agricultural land base; and (d) appraisal of water problems and an evaluation of benefits expected to result from the alleviation of these problems. The results of these studies provides a base for an evaluation of alternative means for meeting production requirements consistent with established national requirements and goals.

Work on the inventory of resource use in the Ohio River Basin is nearing completion. The analysis of these data and 1,700 schedules from a tract study of the basin are under way. The schedules were obtained from field enumeration of farm operations within three miles of 270 preselected weather stations. Information on crop yields and fertilizer inputs are being correlated with precipitation records of the weather stations and detailed soils information.

An interindustrial (input-output) analysis was employed to determine the impact of agriculture on the economy of the Green River Subbasin of the Colorado River Basin. Such interrelationships will be used to project future economic activity in the subbasin. Using 1960 data, it was found that an increase in gross farm product of \$1 generated a total increase in the subbasin's total output (including agriculture) of \$1.50. Further, it was found that agriculture generated the second highest income per dollar of all industries in the Green River Subbasin. The highest direct and indirect effect of \$1 of gross output (\$1.96) occurred in the related "food and kindred products sector."

PUBLICATIONS

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- X Steele, Harry A., and Regan, Mark M. 1962. Formulating and evaluating water resource projects--time considerations. Papers on Missouri and Columbia Basin Inter-Agency Committee meetings. com

AREA NO. 10. RIVER BASIN DEVELOPMENT INVESTIGATIONS

Problem. Water supplies in many areas are either inadequate or imbalanced, resulting in severe competition and a need for its allocation between competitive uses. In some areas, excessive surface flows result in damage to crops, agricultural and nonagricultural buildings, and municipal and industrial installations. Population growth and the enlargement of our industries have contributed to pollution of surface and ground water supplies. The population expansion also creates a demand for land and water for recreational uses. Increasingly serious water management problems give rise to the need for continuing economic studies to guide development of land and water resources, through indicating advantageous allocation patterns and formulating programs that promote efficient resource use. Efficiency in the development and use of natural resources has a positive influence on local and regional well-being and national goals for continuing economic growth. Analysis of resource use and development potentials within this context requires basic data to identify significant relationships between land and water problems and economic growth and to determine the benefits and costs of alternative programs for the alleviation of these problems.

PROGRAM

Current investigations are concerned with the economic appraisal of alternative patterns and schedules of agricultural resource development; participation in river basin plan formulation; and the economic review of Federal agency reports on water-resource development proposals. Studies are concerned with the development and adaptation of systems of analysis and methodology required to identify optimal and balanced patterns of land- and water-resource use and schedules of development for agricultural and related purposes. River basin and project plans are analyzed with respect to their relationship to the agricultural economy and overall regional economic development.

A major portion of the current USDA program of work can be classified as applied economic research. This program is carried out in Washington, D.C. and 9 field locations. Research at the field locations is cooperative with the Soil Conservation Service and Forest Service, and generally includes cooperation with State water resource agencies, the Corps of Engineers, and other public agencies.

Approximately 18.0 Federal professional man-years are currently devoted to the overall research program. Broken down by subareas, the Federal professional personnel commitments are as follows: Economic appraisal of alternative patterns and schedules of agricultural resource development, 2 man-years; participation in river basin plan formulation, 15.0 man-years; and economic review of Federal agency reports on water resource development proposals, 1.0 man-year.

PROGRESS

A. Economic Appraisal of Alternative Patterns and Schedules of Agricultural Resource Development

A system of analysis involving linear programming has been developed which will identify patterns of resource use and development for achieving specified levels of agricultural production at minimum cost. The program permits an evaluation of the economic significance of designated additions, subtractions, or quality changes in the agricultural resource base for given projections of future agricultural product requirements on a basinwide or regional basis. The analysis takes account of major forces affecting the supply and demand of natural resources for agricultural purposes. The system specifies land use, cropping patterns, marginal cost for each commodity group, and total cost for each set of designated conditions. It provides a systematic basis for appraising future needs for resource development, and will identify the long-range regional efficiency gains and/or losses attributable to a given program. This system is being applied to the studies of the Ohio River Basin and the Susquehanna-Chesapeake Drainage Basin.

B. Participation in River Basin Plan Formulation

Economic studies of agricultural and rural community water problems and needs for water-resource development are currently in process in 15 river basins throughout the country.

A survey of the Sevier River Basin is under way in cooperation with the State of Utah and the Sevier River Water Users. The objectives of the study are to appraise the water and land resource conditions, and to provide a basis for deriving an efficient and coordinated program for the basin.

Major factors considered are: (a) The salvaging of water not now beneficially used; (b) a means of providing additional water; (c) appraisal of ground water conditions; and (d) an evaluation of opportunities for beneficial adjustment in present land and water use. An annual progress report indicates the need for storage of streamflows in the area. For example, 30 percent of the tributary inflow occurs during June while only 20 percent of the consumptive use requirements occur during the same period.

Reconnaissance studies of five Oregon River Basins were carried out in cooperation with the State Resource Board of Oregon. The studies are concerned with identifying the opportunities and needs for water resource development. Draft reports were prepared on the Umatilla, Middle Willamette, Lower Willamette, Middle Coast, and South Coast Drainage Basins. Study results indicate there are opportunities for improvements in the management of both water and land resources, as well as opportunities for development of resources to serve all phases of the economy.

The Economic Research Service, through representation on the USDA Field Advisory Committee for the Humboldt River Basin (Nevada), has cooperated in the review of plans and reports on the Mary's River, North Fork, and Maggie Creek Subbasins. The reports present the opportunities for Federal-State-local project-type developments under the Watershed Protection and Flood Prevention Act, and other opportunities for development and adjustment.

Studies in the Gunnison River Basin (Colorado) have been completed. These studies indicate that 18 potential P.L. 566 projects exist in the basin. Results of the study show that the average annual undepleted water supply of the Gunnison River during the period 1943-1960, was 2,175,000 acre-feet. Major use of water, during the same period, was for irrigation of 264,000 acres of land. Installations of these projects would permit the irrigation of an additional 159,800 acres. Principal use of irrigated land is for production of feed for livestock.

Surveys undertaken in the Colorado River Basin were designed to evaluate direct agricultural benefits of "participating irrigation projects" authorized by the Colorado Storage Act. The studies were concerned with the suitability of project lands for irrigation farming, land use and crop production likely to result, cost of developing project land for irrigation use, types and sizes of farms most desirable and most likely to result from project development, and increases in farm income that may be anticipated from new and additional development. A report on the Lyman Project, Wyoming, represents the last in a series of project reappraisals over the period 1956 to 1963. The study results indicate that 3.05 acre-feet of water per irrigable acre would be required at the farm headgate to adequately serve the project lands. Water supplies from project facilities will average 2.43 acre-feet or about 80 percent of estimated requirements. The present "without project water supply" is estimated at 50 percent of requirements. The annual direct agricultural benefits from the 36,000 acres of agricultural land are \$4.39 per acre, or a total of about \$158,186.

Studies have been initiated during the year in the following river basins: Arkansas, Red, Poteau, Meramec, Big Blue, Elkhorn, James, Pearl-Big Black, West Florida Tributaries, and Genesee. The study objectives vary between basins but are concerned with the evaluation of some combination of the following: floods; impaired drainage; drought; impacts of installed projects; alternative means of meeting recreational demands at minimum cost; stabilization of production and income; alleviation of unemployment; and the identification of immediate and long-term needs and other economic evaluations necessary for plan formulation.

C. Economic Review of Federal Agency Reports on Water Resource Development Projects

Economic evaluations of development proposals of other Federal agencies are undertaken for the purpose of preparing general and specific departmental

comments on such proposals. The review of the reports are based on the following criteria: (a) Compliance with the statement of purposes and scope, objectives of planning, and planning policies and procedures set forth in Senate Document No. 97; (b) compliance with law, legislative intent, and executive policies and orders; and (c) compliance with standards for the formulation of plans and evaluation of tangible and intangible effects as set forth in Senate Document No. 97 and other recognized standards and practices.

PUBLICATIONS

Contribution to: Water and related land resources, Gunnison River Basin, Colorado. 1962. USDA report.

Contribution to: A report of reappraisal of direct agricultural benefits and project impacts, Lyman Project, Wyoming. Colorado River Storage Project. 1963. USDA report.

AREA NO. 11. WATERSHED PROGRAM ANALYSIS

Problem. Small watersheds containing about 1 billion acres have land and water problems requiring watershed planning and action for their solution. Under provisions of the Watershed Protection and Flood Prevention Act (P.L. 566), the Department of Agriculture has authorized planning on more than 61 million acres of land and operations on 28 million acres. The watershed program provides technical and financial assistance to local governments and organizations for planning, installing, and maintaining systems of works of improvement for flood prevention, land stabilization, agricultural water management, and nonagricultural water management. Conduct of this program involves evaluations of flood and erosion damages, and appraisals of economic returns from potential drainage, irrigation, water supply, recreation, fish and wildlife enhancement, and other purposes of land and water resource development. Watershed projects are planned to achieve optimum economic efficiency of resource allocation with consideration given to other local, regional, and national objectives. Benefit-cost analyses of proposed works of improvement necessitate application of systematic economic appraisals. To be consistent with national resource policy, general procedures are developed on a coordinated basis with other Federal agencies having land and water resource development responsibilities.

PROGRAM

The current research program treats with the economic and related institutional aspects of watershed planning, development, and management. More specifically, it includes inventory and economic analysis of authorized watershed development plans and projects; economics of watershed development and management in the Washita River Basin; formulation of methodology for selected evaluation problems; and problems of local organization in planning, installing, and operating watershed projects.

The program is undertaken in Washington, D.C., and in field locations at Little Rock, Arkansas; Fort Collins, Colorado; Stillwater, Oklahoma; and University Park, Pennsylvania. In Oklahoma and Pennsylvania, the research is conducted in cooperation with the respective State experiment stations. The program of work is provided for by a memorandum of agreement with the Soil Conservation Service, executed in 1955, and its composition is designed by means of annual work plans prepared cooperatively by the two Services.

A total of 10.0 Federal professional man-years currently is devoted to the area as a whole. By subareas of work, professional time is allocated as follows: (A) Inventory and economic analysis of authorized watershed development plans and projects, 4.5 man-years; (B) Economics of watershed development and management in the Washita River Basin, 2.5 man-years; (C) Formulation of methodology for selected evaluation problems, 2.2 man-years; and (D) Problems of local organization in planning, installing, and operating watershed projects, 0.8 man-year.

PROGRESS

A. Inventory and Economic Analysis of Authorized Watershed Development Plans and Projects

Under Public Law 566, 494 watershed work plans, covering about 28 million acres of land, were authorized for operations as of September 1, 1963. Regional and national summaries of the recommended works of improvement, costs, flood damages, benefits, and other related data are nearing completion and will be issued for limited distribution. Similar inventories were prepared for 1961 and 1962. The 1962 report, containing information on 385 work plans, indicated average annual flood damages of \$30.4 million, of which about 62 percent was to crops and pasture, 5 percent to other agricultural property, and the remaining 33 percent to nonagriculture. Average annual installation costs of works of improvement averaged \$25.25 per acre of watershed, of which 69 percent was for structural measures and 31 percent for land-treatment measures. Of the \$29 million benefits evaluated, about 89 percent is from flood prevention and the remainder is attributed to agricultural water management and uses of water for municipalities, recreation, and other nonagricultural purposes. Regional summaries of the work-plan data show significant variations in several factors such as size of watershed, kinds and costs of works of improvement, flood damages, and benefits. For example, annual flood damages per acre of watershed range from \$1.18 in the Great Plains to \$4.80 in the Pacific Coast. Storage structures account for 19 percent of the total project costs in the Pacific Coast but 62 percent in the Great Plains.

For the mainland States, watershed projects have been approved for slightly less than 2.2 percent of the total area estimated to require project treatment. In the Atlantic and Gulf Coastal Plain, and the Appalachian-Ozark Highland regions, the corresponding ratio exceeds 3 percent and in the Rocky Mountain Region, it is about 0.18 percent.

Economic studies of impacts of watershed protection were continued in 7 Pilot Watershed Projects (Pilot Watershed Protection Program authorized by the Appropriation Act of 1954). These long-term evaluations include the watersheds of Plum Creek, Kentucky; Six Mile Creek, Arkansas; East Willow Creek, Minnesota; Honey Creek and Mule Creek, Iowa; Upper Rio Hondo, New Mexico; and Kiowa Creek, Colorado. Technical evaluation reports in draft stages have been prepared for 3 of the projects and are presently being reviewed for publication. Joint ERS-SCS evaluation studies will be continued in the watersheds of Six Mile Creek, East Willow Creek, Mule Creek, Upper Rio Hondo, and Kiowa Creek.

Results of these evaluations to date are not conclusive with respect to verification of preinstallation expectations. Anticipated benefits of the watershed installations were based upon mitigation of flood, erosion, and sedimentation losses resulting from storms of infrequent occurrences, as well as those of 1-, 2-, or 5-year intervals. Thus, a 5- or 10-year period of

observation is too short a timespan to fully appraise the effects of most watershed projects. However, evaluation findings at this stage of study reveal some trends resulting from installed works of improvement. The quantities of measures installed in general were less than the number recommended, especially with respect to structural measures. In the watersheds of Honey Creek and East Willow, where the major purpose of structures was gully stabilization, land-treatment measures were substituted in several instances for structures. In Kiowa Creek, the dams installed for flood protection and grade stabilization were larger than planned and the installation of land-treatment measures was impeded by dry weather during much of the installation period. A smaller than initially planned quantity of channel improvements and floodwater retarding structures were installed in Plum Creek. However, more critically eroding areas were revegetated than the quantity planned initially. In the humid area watersheds, pasture improvement nearly attained the planning goals, but the treatments generally were not as intensive in scale as those planned.

Flood damages in all of the watersheds studied were less than would have occurred in the absence of improvements. Average annual benefits from this source in proportion to the planning estimates varied by watersheds. In Six Mile Creek, the flood damage reduction benefit appears to be greater than was expected. Enhancement of flood plains due to reduced flood risk took place in Honey Creek and Kiowa Creek. Analyses of recorded annual data showed relatively greater gains in value of production on the flood plains of these watersheds than on their respective uplands. In Six Mile Creek, flood-plain pastures were revegetated and managed more intensively than formerly. Plum Creek evaluations, however, revealed a relative decline in value of flood-plain output, but production on uplands, both crops and livestock, increased substantially. Returns to farmers from revegetation of critically eroding areas in Plum Creek averaged \$7.02 per acre annually net of all costs, both private and Federal.

During a 5-year period in Honey Creek Watershed, annual benefits from reducing potential flood damages to crops averaged \$622 or about \$1.50 per acre of flood-plain land. In addition to this gain, farmers planted relatively more of their corn crop on the bottom lands. Crop income on these lands indicated a consistent increase between 1955 and 1961 following installation of the watershed project. Gully damage prevented from the installed structures and terrace systems averaged \$1,670 per year, and farm income increases attributed to increased forage from pasture improvement totaled \$10,000 per year of observation.

Considerable recreational use is being made of the reservoirs and surrounding areas of floodwater-retarding structures in several of the watersheds. Although not quantified in monetary terms, there has been a considerable benefit from recreation. This was over and above any type benefit planned or appraised during project formulation. In Six Mile Creek, waters impounded by floodwater-retarding structures are being used as sources of supply for industrial and municipal requirements.

B. Economics of Watershed Development and Management in the Washita River Basin

Major emphasis of watershed studies in the Washita River Basin is placed on evaluating actual and potential effects of upstream watershed development on changes in use of flood-plain land, values of water supplies for irrigation and recreation, and secondary income and its distribution in the local economy. A study technique was devised to indicate how the incomes of different economic groups within a county are exchanged for goods and services among the several groups. Application of the technique on a trial basis indicates its practicability for measuring the amount of secondary income generated by watershed investments. The land-use phase of the study indicates generally the intensification of flood-plain land use following flood protection; however, in some instances where the ground-water table appears to have been raised, the reverse of this change has occurred. Tentative findings also indicate that other production and income risks, along with the flood hazard, influence the use of flood-plain lands and that these factors need to be analyzed in predicting the impact of reduced flooding on farm operations.

The irrigation study is designed to measure the potential value of water in upstream floodwater-retarding structures for this purpose. Linear programming has been used to specify optimum enterprises for six typical farms, assuming three different weather situations. The weather conditions assumed were based on long-range trends in climatic conditions and provide the basis for computing supplemental irrigation needs. This phase of the watershed research program is near completion and a comprehensive report on the result of this research is under preparation.

The land-use study will quantify in physical and monetary terms the effect of upstream flood protection on flood-plain land use. An extensive farm survey (150 schedules) was conducted and is currently being analyzed. Farm enterprise budgets developed in the irrigation study have been modified to take into account differences in soils, climate, and production practices. Variable resource programming is being used to determine the long-range impact of flood protection on flood-plain land use.

An analysis of the secondary effects of watershed development is near completion. The "Leven modification" of Leontief's input-output model was the basic conceptual model used in determining the magnitude and distribution of secondary effects. This research provides a systematic scheme for determining the local economic impacts of development and provides a basis for specifying local cost-sharing arrangements. A comprehensive research publication and several supplemental reports on specific phases of this study are currently in progress.

Another phase of the Washita studies examines the institutional factors affecting the progress of project development. The first phase of this study will examine the association (or disassociation) of costs and benefits of installed watershed improvements on a case basis.

C. Formulation of Methodology for Selected Evaluation Problems

Surveys were undertaken to develop rates of flood damage to growing crops in the Southeast and in the Great Plains with the objective of preparing schedules of damages that can be applied in watershed planning with minor local modification. Flood damage appraisals in watershed planning usually require for each major crop the range in estimated damage by potential depth of inundation for different stages of crop development. This range of data cannot be established satisfactorily from a record of flood experiences in the individual watershed. The first report of this study was made on corn in southeastern Kansas and transmitted to the Soil Conservation Service. By use of statistical techniques, damages expressed as percentages of yield reduction were related to depth of flooding, by months. A second report was prepared for damages resulting from floods in the Red River Valley of the North, North Dakota. In the Piedmont of the Southeastern States, several hundred records of damages to major crops have been obtained and will be similarly analyzed. As studies are completed for other resource areas, comparisons in the rates of damage by stage of plant growth may be made. The effects of flood characteristics other than depth of flooding may become measurable as the number of available damage observations increases.

Recreation research for watershed development programs is centered mainly on the establishment of standards and methodology for evaluating recreation benefits and the formulation of watershed projects to include economically feasible features for recreation. Statistical analyses are under way of a nationwide survey of recreational use of lakes or reservoirs open to the public. Based on approximately 1,500 returns, relationships are being established between visitor days' use and physical attributes of the lakes, such as surface water area, adjacent land area used for recreation, number and kinds of facilities, and type of management. Other related factors being considered are neighboring population and proximity to similar recreational sites. Relationships will be explored within States, regions, and groups of States. One aggregate summary indicates an average of 837 annual visitor days' use per surface-acre of water in the North Central States, and a low of 125 in the Rocky Mountain States. After analysis of the variables reported by the survey, the use of secondary statistical data concerning population, employment, income, and expenditures will be explored as determinants of recreational use.

A study of fee-fishing lakes in Pennsylvania involves physical attributes, management practices, kind and quality of fishing, volume of use, fees charged, and other related data. Attempts will be made to differentiate the recreation product and to identify and evaluate some of the factors which influence the volume of use and supply of fishing. Preliminary results of this study have been compiled in a mimeograph of working data for administrative use which has been distributed to all State conservationists of the Soil Conservation Service and representatives of other agencies concerned with recreation programs.

D. Problems of Local Organization in Planning, Installing, and Operating Watershed Projects

Study is currently under way to determine the effect of institutional, financial, and related socioeconomic factors on the rate of carrying out approved watershed projects. Special attention is given to the right of eminent domain, taxing authority, and the ways in which these powers are used by local governments in performing their project responsibilities. Based on preliminary study of 16 States, sponsors of 86 percent of the approved projects (January 1, 1961) had powers of eminent domain and taxation. However, the rate of construction progress indicated no relationship with the availability of these legal authorities. The rate of progress appears to be more nearly related to the project purposes. For example, projects having prevention of urban flood losses or gully stabilization as their dominant objectives show substantially greater progress than those projects where agricultural flood prevention and land-use changes of the flood plains are dominant. Obviously many other factors are involved and case studies are required for greater understanding of the problems involved. In this connection, surveys of approved watershed projects are being started in Oklahoma.

PUBLICATIONS

A. Inventory and Economic Analysis of Authorized Watershed Development Plans

Inventory of basic data: Public Law 566, Watershed Work Plans.
1962. ERS. Mimeo.

Jansma, J. Dean, and Anderson, Dale O. Water: A critical factor in planning community development. Yearbook of Agriculture. 1963.

B. Economics of Watershed Development and Management in the Washita River Basin

Jansma, J. Dean. 1963. Estimating accounts and economic structure for an Oklahoma county: A preliminary view. Presented at Workshop on Regional Development Analysis, Oklahoma State University, May 8-9. Mimeo.

Jansma, J. Dean. 1963. A selected bibliography on secondary benefits. ERS. Ditto.

C. Formulation of Methodology for Selected Evaluation Problems

Mallett, Nathan G. 1962. Evaluation of flood damages to growing crops: Interim report on snow-melt and summer floods, Red River Valley of the North, North Dakota. ERS. Mimeo.

Street, Donald R. 1963. A preliminary report on the economics of regulated fee-fishing lakes in Pennsylvania. ERS. Mimeo.

Line Project Check List--Reporting Year October 1, 1962 to September 30, 1963

Work & Line Project Number	Work and Line Project Titles	Work Locations During Past Year	Line Proj. Incl. in	
			Summary of Progress	Area & Sub- heading
<u>RDE 1</u>	<u>Land Utilization</u>			
RDE 1-1	National land use inventory	Washington, D.C.	Yes	1-A
RDE 1-2	Economic appraisal of land resource development in the United States	Ames, Iowa	Yes	1-B
RDE 1-3	An economic appraisal of the federal agricultural land purchase and development program of the 1930's*	Washington, D.C.	Yes	1-A
FE 5-3	Development of economic land classification techniques for the Great Plains **	Lincoln, Nebr.	Yes	1-A
FE 5-4	An economic evaluation of agricultural land drainage and related management of farms in Michigan ***	East Lansing, Michigan	No	
Fe b3-10	Economic appraisal of changes in agricultural land use and ownership associated with opportunities for off-farm employment in Virginia **	Blacksburg, Va.	No	

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** Terminated during reporting year.

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<u>RDE 2</u>	<u>Water Use and Management</u>			
RDE 2-1	Economic appraisal of agricultural water use and supply	Washington, D.C.	Yes	2-A
RDE 2-2	Improved methods for the economic evaluation of land and water resource development projects and programs	Washington, D.C.	Yes	2-B
RDE 2-3	Economic appraisal of humid-area irrigation trends, potentials, and water values	Washington, D.C.	Yes	2-A
RDE 2-4	Economics of watershed management	Washington, D.C.	Yes	2-B
RDE 2-5	Economics of land forming for water management in selected Eastern States	Ames, Iowa	Yes	2-B
RDE 2-6	Economic appraisal of irrigation water conveyance systems in California	Berkeley, Calif.	Yes	2-B
RDE 2-7	A study of the characteristics, use, and occupancy of rural flood plains in the United States	Chicago, Ill.	Yes	2-B
RDE 2-8	An economic study of values of water for irrigation and competing uses in the Upper Colorado Basin	Fort Collins, Colo.	Yes	2-A
RDE 2-9	Values of water for irrigation in the Willamette Valley	Corvallis, Ore.	Yes	2-A
FE 6-1	An economic investigation of supplemental irrigation in selected humid areas in eastern Texas ***	College Station, Texas	No	
FE 6-2	Economic appraisal of supplemental irrigation in Mississippi ***	Stoneville, Miss.	No	
FE 6-3	An economic appraisal of the use of water for irrigation on Missouri farms ***	Columbia, Mo.	No	
FE 6-12	Profitable farm allocations of limited irrigation water in the Upper Colorado Basin **	Logan, Utah	Yes	2-A
FE b2-14	Economics of watershed protection programs in Oklahoma **	Stillwater, Okla.	No	
FE b2-15	An economic study of the high water table problem, Newlands Reclamation Project, Nevada **	Reno, Nev.	No	
<u>RDE 3</u>	<u>Resource Institutions</u>			
RDE 3-1	Legal aspects of water rights in the West	Berkeley, Calif.	Yes	3-A
RDE 3-2	Legal aspects of water rights in the East	Madison, Wis.	Yes	3-A
RDE 3-3	Analysis of rural zoning enabling statutes and ordinances	Washington, D.C.	Yes	3-B
RDE 3-4	Economic appraisal of local resource organizations	Washington, D.C.	Yes	3-C
RDE 3-5	Analysis of the feasibility of easements and protective covenants for guiding rural land use	Lincoln, Nebr. & Washington, D.C.	Yes	3-D
FE 7-2	Appraisal of the economic impacts of highway construction on agriculture in Wisconsin *	Washington, D.C.	Yes	3-D

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Line Project Check List--Reporting Year October 1, 1962 to September 30, 1963

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<u>RDE 4</u>	<u>Land Tenure</u>			
RDE 4-1	Development and analyses of basic farm tenure information	Washington, D.C.	Yes	4-A
RDE 4-2	Appraisal of economic aspects of land tenure laws	Iowa City, Iowa	Yes	4-B
RDE 4-3	Maintenance of information on farm leases	Washington, D.C.	No	
RDE 4-4	Analysis of the family farm corporation as it affects tenure and resource use	Ames, Iowa	Yes	4-B
RDE 4-5	Economic appraisal of interrelation between farm tenure arrangements and agricultural production control programs in the Southeast	Raleigh, N.C. & Blacksburg, Va.	Yes	4-C
RDE 4-6	Analysis of legal economic aspects of contract farming	Iowa City, Iowa	Yes	4-B
RDE 4-7	Analysis of land tenure problems and policies of Puerto Rico	Rio Piedras, P.R.	Yes	4-C
FE 8-4	Economic analysis of farm tenure in resource use adjustment in Iowa *	Ames, Iowa	No	
FE b5-13	Economic analysis of the effect of land ownership patterns on resource development in the low income area of Northern Wisconsin	Madison, Wis.	No	

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<u>RDE 5</u>	<u>Urban Impact</u>			
RDE 5-1	Land use adjustments on the rural-urban fringe	Washington, D.C. & Newark, Del.	Yes	5-A
RDE 5-2	The economics of outdoor recreation as a use of rural lands	Washington, D.C.	Yes	5-B

Line Project Check List--Reporting Year October 1, 1962 to September 30, 1963

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<u>RDE 6</u>	<u>Economic Development Problems and Programs in Rural Areas</u>			
RDE 6-1	The dynamics of physical and human resource use adjustment to specified areas	Lexington, Ky.; Ithaca, N.Y.; Blacksburg, Va.; Morgantown, W. Va.	Yes	6-A
RDE 6-2	An evaluation of rural resource use and potentials for economic development--selected low income areas in Arkansas and adjoining States	Little Rock, Ark.	Yes	6-B
RDE 6-3	An economic evaluation of recreation as a use of resources in the Ozarks of Missouri	Columbia, Mo.	Yes	6-B
RDE 6-4	Training and education as a means of providing more job opportunities for workers in low income areas	Lafayette, In .	Yes	6-A
RDE 6-5	An analysis of factors affecting resource adjustments in low income rural areas in Michigan	East Lansing, Michigan	Yes	6-A
RDE 6-6	Economic appraisal of opportunities for outdoor recreation enterprises on farms in southeastern Ohio	Columbus, Ohio	Yes	6-B
RDE 0-0-1	Economic analyses and appraisals for programs of area redevelopment, rural development, or general economic development in rural areas of low production and income **	Washington, D.C.; Clemson, S.C.; Fayetteville, Ark.; Starkville, Miss.	Yes	6-B
FE e4-10	Economic appraisal of changes in use of agricultural resources, farm organization, and income to farmers resulting from changes in off-farm employment opportunities in North Central Pennsylvania *	University Park, Pennsylvania	No	

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Line Project Check List--Reporting Year October 1, 1962 to September 30, 1963

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<u>RDE 7</u>	<u>Incomes, Employment, and Resources of People in Selected Rural Areas</u>			
RDE 7-1	Economic appraisal of adjustments in the use of resources on low income farms in the Willamette Valley of Oregon	Corvallis, Oreg.	Yes	7-B
RDE 7-2	An appraisal of farming adjustments associated with increased nonfarm employment of farmers in a commercial farming area of Texas	College Station, Texas	Yes	7-B
RDE 7-3	Opportunities for adjustments of farms and farm families in low income farming areas of Mississippi	State College, Mississippi	Yes	7-B
RDE 7-4	Facilitating farm enlargement and extensive land uses in low income areas of North Florida	Gainesville, Florida	No	
RDE 7-5	Appraisal of characteristics of successful farms and farmers in low income areas	Washington, D.C.	No	
RDE 7-6	Income and resource characteristics of farm operator families	Washington, D.C. & Raleigh, N.C.	Yes	7-A
FE b3- 10(s)	Economic appraisal of changes in agricultural land use and ownership associated with oppor- tunities for off-farm employment in Virginia **	Blacksburg, Va.	No	
FE e4-11	Appraisal of opportunities for improving the economic status of farm people in eastern Tennessee with emphasis on low income farmers **	Knoxville, Tenn.	Yes	7-B

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<u>RDE 8</u>	<u>Rural Area Economic Structure and Economic Growth</u>			
RDE 8-1	The relationship of urban and industrial development of low incomes in agriculture	Washington, D.C.	Yes	8-A
RDE 8-2	Evaluation of alternative development opportunities in low-income rural areas *	Clemson, S.C.	Yes	8-B
RDE 8-3	Effects of national economic development upon the development of low income farm areas in North Carolina	Raleigh, N.C.	No	
RDE 8-4	Analysis of economic development in the Appalachian Region--including changes in the composition and location of employment and income with special reference to urban-rural differences *	University Park, Pennsylvania & Morgantown, W.Va.	Yes	8-B
FE e4-7	Analysis of factors and problems in economic progress of low-income farm areas **	Washington, D.C.	No	

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